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Investigate the Inefficient

By K. H. Condit
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HOW many machinery builders could stand a Government investigation into their methods of conducting their companies? This question may sound silly because investigations by tax officials, inspections by safety officers and snoopings by other functionaries have inured them to Government investigating and shown them how to get from under with the least possible loss of skin. But the kind of investigation meant is the kind to which Owen D. Young referred in a recent address before the National Industrial Conference Board.

Mr. Young is quoted as follows: "Industry should be profitable. It would be a good idea if the Government should change its policy. I have noticed for a number of years that whatever investigation was to be made, was of a concern that made some profit. Suppose we reverse the policy. I know of no way concerns can make profits unless they render service, and, conversely, if they do not make profits they cannot render service."

THAT statement is worth reading more than once for it contains a whole philosophy of industry. Let us suppose, for a moment, that a careful and expert investigator were ordered to study the affairs of a machinery-building company to determine how profitable its operations were, and, if unprofitable, why. What would he find?

In the shop he would find a group of machinists of more than ordinary skill, under the direction of foremen above the average in ability. Something more than half the shop equipment would be less than ten years old. Methods would be good considering the sizes of lots going through the shop. Rates of pay he would find to be inadequate.

THE engineering department, on investigation, would produce technical talent second to that of no other industry, with perhaps one exception. It is possible, although not inevitable, that he would find the technical talent engaged in adapting the ideas of other designers to the needs of their employer. And why? Because there was no research in progress to reveal new physical facts that they might utilize in solving their own problems. The investigator might find a certain lack of enthusiasm in this department engendered by too much worry over personal financial problems, brought on in turn by inadequate salaries.

What of the sales department, and sales methods? The situation here would depend on the policy of the company, selling direct or through agents. In either case our investigator would probably discover sales efforts spread too thin over a line of product that had outgrown reasonable bounds. Too many of the salesmen would be found to be mere order-takers, unable to answer the searching ques-

tions of prospective customers adept in the latest shop practice. He would find attempts being made to get business that might much better be left alone because of the small possible profits.

He would surely unearth free mechanical service impossible to justify on any ground other than pure fright, and free engineering service that bordered on charity, depending in extent on the rapacity of the customer. He might discover an unpleasant willingness to believe anything said about the size of a competitor's bid by an unscrupulous purchasing agent. And he would be likely to uncover a lack of study of the real markets for the product of the company.

HAVING discovered these facts any good investigator would naturally search for the reasons of their being. And, being an experienced man, he would head straight for the general manager or the president, depending upon which official exercised final authority. What would he find?

The chances are about three to one that in and around the executive offices there would be an atmosphere of apprehension. Apprehension as to what the company's competitors might be doing in the way of new designs or clever selling stunts. Dread of the attitude of some hard-boiled purchasing agent, noted for his ability to beat down prices. Fear of an impending slump in business, induced by all too recent memories of the narrow escape from failure during the last depression. Worry lest some big customer should take it into his head to build his own machine equipment instead of buying it. Concern over the small proportion of foreign business on the books of the company and the growing imminence of intelligent competition from abroad. And these are only a few of the real and fancied evils that face the executive of the equipment manufacturing company.

WHAT effect do they have on business policy? Just this—a weakening of morale that is evident in prices for the product that are entirely too low, and, to make matters worse, a general tendency to shade even these low prices when sufficient pressure is brought to bear by interested parties.

The margin between cost and selling price is not sufficient to permit of the establishment of adequate reserves to take care of dull periods, or to conduct vitally necessary research and investigation, or to pay wages and salaries high enough to hold valuable men when some one tries to hire them away. The margin is inadequate to cover the cost of proper selling effort either in personal salesmanship, advertising or dealer commissions.

Could our investigator of efficiency make anything but an adverse report in such a case as this? He could only say that the very real service demanded of the machinery builder by industry and by the community was being seriously curtailed because of the builder's manner of conducting his business. He would have to report that the remedy indicated was a stiffening of the moral backbone of the builder investigated and the moral backbones of all of his competitors as well. That evidently profit ideals were not high enough and that prices must be increased and maintained before the builder could meet his obligations of service.

MR. YOUNG'S suggestion may seem a little extreme to some of us slaves to tradition but it would certainly revolutionize the machinery-building industry if it could be applied. The thought of a Government investigation of any kind is anathema to the average citizen and especially to the business man.

Therefore, why not start the investigation within the industry so that the cancer can be cured before the Government surgeon is called in as a kill-or-cure last resort?

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S.A.E. Production Abstracts

These papers were presented September 21-23 at the production meeting of the Society of Automotive Engineers, held at Chicago

Inspection Along the Line

By A. H. Frauenthal
Chandler Motor Car Co.

ONE of the greatest benefits of inspection service comes from its power to bring promptly to the attention of the department foreman and production control departments information on the difficulties encountered with material and equipment. There is always a tendency for work to slip away from the established standards, usually by such small daily increments that the changes are hard to detect. Tools, measuring devices, gages and precision instruments are subject to wear, and the fact that the wear does not take place rapidly makes it necessary for the inspector to be even more vigilant in the inspection. The ultimate effect is that in spite of every reasonable precaution errors will be made that will not be detected until the parts are issued for assembling.

Frequently the effect is manifested first by increased difficulty in assembling, which is fortunate as it draws immediate attention to the basic trouble. On the other hand, the errors may make the parts easier to assemble, which is quite dangerous. This seems to indicate that the entire inspection department should be placed on a quality bonus basis.

Just why inspection is classified as indirect is sometimes hard to understand. Inspectors are just as essential to the production of any product as the machine operators, and without them manufacturing would fail to function. While it is true that the inspector does not actually produce, he forms a part of the producing element which ultimately is responsible for the final finished production, and therefore is a part of the production of that particular unit. Line inspection is tied up so closely with production that it would be some trouble to segregate it as indirect. Inspection does not come under the same classification as clerks, or office help, but comes within the scope of actual manufacturing.

It can readily be seen that the majority of phases of inspection work can be analyzed to determine with approximate certainty the actual number of inspectors required for the economical and quality production of the product. The savings which can be effected in material, the safeguarding of quality, the prevention of waste, and suggestions for more economical methods, play an important part in manufacturing, and can probably be put on some kind of incentive basis.

While practically all direct labor in the automotive industry has been subjected to the closest scrutiny of industrial engineers, and very substantial savings have been made, the so-called indirect workers have been sidetracked, and it is reasonable to assume that proportionately great savings can be made in this division of manufacturing.

We have found at least five reasons for using time studies or inspection work. The individual inspector knows that a certain amount of work is expected of him, and it is needless to state that a man will produce more work when given a definite assignment than when working at random. The foreman can also check the inspector's output daily, and the chief inspector can check the department's output over any given period of time. Time study draws the attention of every one concerned to the possibilities of economizing by better methods, mainly by showing up the extreme slowness of some operations. Finally, it is of assistance in planning the work.

A method of allotting a definite time interval for a given inspection is to adapt the inspection to a station in the production line with a definite inspection specification balanced in time with the production operations. In some plants it is the practice to test for hardness all large castings, such as cylinder blocks in the rough, previous to delivery to the machine line. A few plants have adopted the method of using a small percentage hardness inspection in the rough as a pre-check and have mounted a hardness testing machine in a conveyor line in such a manner that it is possible to test each cylinder with no extra handling.

In one Detroit plant there is a continuous chain conveyor for the assembly of instrument boards. There are twelve stations, the last being occupied by the inspector. This inspector has a certain number of items to inspect, and the operation is balanced with all remaining operations. The mere fact of having this inspection on a conveyor has speeded it to a point where the inspector is doing about double the work that would normally be expected if done over a bench.

In the case of machined cylinder block inspection, we are making plans to put an inspection station at the end of the line. This will insure that the inspector

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works fast enough, but another problem will be to make him careful enough. To accomplish this we might penalize him for bad work that gets by, or we might pay him a bonus on rejections. The objection to a penalty is that all of the poor material would normally not be caught, and the inspector might take many risks to increase his earnings. If he is paid a bonus for rejections, his tendency might be to reject all blocks possible, but this could be cared for by having his rejections gone over by the machine shop inspection foreman. Inasmuch as it is common practice to have rejections checked by a higher authority there would be no extra cost involved. It seems probable that stations of this kind will eliminate some of the machine inspection.

Conveyors in the Automotive Industry

By Clarence E. Brock
Miller-Hurst Corporation

CONVEYORS are installed in manufacturing plants to give a continuous, co-ordinated, and easily controlled flow of materials through the factory and yards; to use the more direct routes not available to other means of transportation; to avoid much of the expense and loss of space due to rehandling between operations; to avoid handling of heavy, sharp, sticky, or hot materials; to time operations without depending upon the vigilance of the attendant; to provide when necessary a temporary storage on the conveyor line itself; and in many cases to do the work of operations, such as dipping and agitating.

The plans for installing conveyors for a given manufacturing process consist of listing the successive operations with respective rates of production and spaces required; determining the suitable types of conveyors; planning to keep as many consecutive operations as possible on one conveyor without rehandling; considering the available buildings with a view to convenience and economy; and finally co-ordinating the system.

Common types of conveyors adapted to the industry are: Floor conveyors to push lines of bodies; canvas and rubber belt conveyors to handle bulk materials; open wire mesh belt conveyors for metal washing machines; trolley conveyors for overhead delivery; double strand conveyors for dipping, drying, and assembling; drag flight conveyors from raw bulk materials fed to numerous bins from the conveyor trough; gravity rolls to move work between machines; wood and steel apron conveyors to handle parts and boxes; and revolving platforms to rotate groups of production machines to the successive operators when more than one operation is performed on a given machine.

Most of the power-driven conveyors employ chains, and these chain specifications vary. The typical enameling conveyor requires chains having strength to take the load, large live-pin bearing area to stand the wear at numerous bends, and a small mass per unit of length in order to absorb as little oven heat as possible.

The typical monorail conveyor requires a chain capable of reasonable lateral flexure for traveling along curves in a vertical plane. The conveyor handling gritty substances must have a large protected area of pin bearing, mass at the joints, and perhaps a large drag surface area.

Malleable or combination chains are good for general work. Steel bar, bushed chain is strong, wears well, can be made of accurate pitch, and is adapted to rollers. Forged chain may be designed very strong and light. It also may be made detachable, and of few parts.

The sliding friction coefficients of conveyor chains, either loaded or unloaded, dragged on horizontal steel track without rollers is about 20 per cent of the vertical gross load on the chain when the chain is in motion. Ordinary chain rollers add life to the chain, and give a coefficient of friction of about 15 per cent for 1½-in. rollers and as low as about 6 per cent for 6-in. rollers with plain bearings.

The starting load on conveyors may range from 50 per cent to several hundred per cent above normal running load. Conveyor chains should probably never be run at a greater working stress than 20 per cent of the ultimate strength, even at slow speeds with heat-treated chain of high elastic limit.

Designs should give symmetry of attachments about the center line of chain and of conveyor to avoid eccentric loads. Automatic takeups to allow for expansion and contraction of long conveyors may be of the gravity type, in which case the slack is taken up by a counterweighted carriage, or by a mere sag in the chain as it leaves the drive sprocket. Vertical and nearly vertical drive chain operating on horizontal shafts should have tighteners. Horizontal drive chains operating on horizontal shafts run best with the tight side on top. They then run free on the sprockets, avoid kinks in the chain, and prevent interference of strands on long, slack chains. If a chain reduction be used on vertical shafts, a tightener should be installed, and the chain itself should run on guides.

When a conveyor uses two or more parallel strands of chain, all conveyor chain drive sprockets are keyed to the drive shaft with teeth in line, but only one sprocket on any one takeup or idler shaft is keyed to that shaft. This allows the other sprockets on the shaft to idle freely, and prevents one chain from taking more than its share of the load when strands are not perfectly matched. Drive sprockets running at considerable speed should have 12 or more teeth to prevent shock due to unevenness of drive. Very slow speed drive sprockets may successfully run with as few as six teeth.

In many conveyors employing two strands of parallel chains, and carrying loads suspended from spacer bars, as in the case of enamel ovens, through shafts would

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interfere with the hanging loads, and stub shafts must be used at the vertical bends. Some oven manufacturers require these stub shafts to be wholly within the oven to prevent heat loss by conduction through the shaft. In such cases the stub shafts are often held stationary, and the sprockets are made to idle on roller bearings.

The automotive industry usually demands greater service of a conveyor than could be determined at the time of its installation. Usually this demand is in the form of increased speed of travel. In the case of oven conveyors, the time in the oven tends to determine the speed of the conveyor, but the oven time principle is nevertheless often violated when production requires. Consequently a conveyor drive should be reasonably adjustable to the possible demands of speed. Most conveyors are strong enough to stand speeding up, but with consequent sacrifice of conveyor life. Greatly increased speed will require increased driving power, and often a larger motor.

Drives may be classed as constant speed and variable speed. An economical constant-speed drive for a heavy, slow-speed conveyor with horizontal drive shaft consists of a motor directly connected to an inclosed gear reducer with roller chain reduction to head shaft.

Remote control push buttons should be placed at strategic points to stop a conveyor instantly should occasion demand. Limit switches should be used where they may prevent injury to men or property. A simple form of safety switch is a wire stretched across an open space and arranged to pull a switch in case a man or object should be drawn into danger.

The mechanical variable speed transmission ordinarily used consists of a belt running over adjustable pulleys which change ratio of diameters. Adjustment of speeds near zero cannot be obtained, but ratios between highest and lowest speeds obtainable on some models of this type are as great as 8 to 1. This type of variable speed transmission is dependable.

The electrical variable speed devices may be divided into those that can be adjusted to give continuous definite speed regardless of load, continuous definite at constant load only, and definite travel regardless of load, but with pulsating speed.

Conveyors are used in some plants as pace makers in production. In at least one such plant, variable speed drives are adjusted on all conveyors to give a definite, balanced day's output. The respective drive adjustments are then locked in place, and the conveyors are kept at capacity. The scheme seems to be satisfactory.

The Production of Automobile Gears

By Walter G. Hildorf and John Bethune
Reo Motor Car Co.

THE production of satisfactory gears is one of the most serious problems confronting the automobile manufacturer, and the choice of gear steel and its heat treatment is closely allied to this production problem. Some radical changes are going to be made in automobile gearing during the next few years, and a frank interchange of ideas will hasten the time when a more satisfactory system of gearing will be developed.

The operations in turning the gear and pinion of rear axle gears are conventional. The gear and pinion teeth are roughed in the usual way on gear and pinion roughers, care being taken to rough slightly deeper than the full depth and to use a roughing cutter of the same diameter as the finishing cutter.

The gears are finished by the spread-blade method, but the pinion is not finished in the usual way. The new method is to put the pinions, after the teeth are roughed, in a fixture mounted on a small milling machine, and cutting a ⅛-in. keyway in the stem. This fixture has a plunger which enters a tooth space, so the keyway is cut in a definite relation to the teeth.

We have called this the duplex method, and consider it superior to the old method, both for production and quality. One of its advantages is that twice as many blades are in action at any one time. The time to finish a tooth can be reduced, and the profile improved at the same time. The tooth profile can be changed on either the drive side or the reverse side at will, without interfering with the other side. It is often desirable to "flank" or "top" the drive so as to get a better running position without disturbing the reverse side. By means of this method it can be done easily and a better balanced tooth produced. Sometimes it has been found desirable to cut the drive side with one ratio of roll and the reverse side with a different ratio.

One of the objections to the use of the 9-in. cutter has been that it produced too short a lengthwise bearing. With the old method of cutting, nothing could be done to correct this, but with the duplex method the radii of the blades can be changed at any desired length of bearing produced. Therefore, the advantages of the 12-in. cutter can be combined with those of the 9-inch.

Due to the fact that all blades are on one side they can be made wider at the point, which adds to the life of the cutter. With the old method the operator had to make two accurate dial adjustments for each pinion. With the duplex method these adjustments are eliminated, the only thing required of the operator is to put the pinion into the machine and remove it after the teeth are cut on one side. The two chuckings necessary with the duplex method take about 25 per cent less time than the chucking plus the time taken to divide the stock and make the "set over" by the old method.

After the gear teeth are roughed, they are chamfered on the large end, or outside of the gear. A vertical hobbing machine with a special hob is used for this purpose. We consider it better to do the chamfering before the teeth are finished because it might raise a burr on the tooth profile.

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The gears and pinions are run in a bevel-gear testing machine to determine if they have the correct lengthwise and profile bearing and that they run on the correct center distance. Corrections are made in the usual way with the exception that with the duplex method we can change the running position of one side of the tooth without disturbing the other side.

Burnishing and Lapping

The pinions are burnished in a burnishing machine without any oscillating movement of the pinion. A light tension is used, and the gear is raised and lowered continuously so that all parts of the teeth come into contact. The gears are then heat-treated, and afterwards ground on the back and in the bore. When grinding the bore the gear is trued up by the bore with an indicator mounted on a special holder.

The gears are put into pairs on a testing machine, and then lapped on a lapping machine. They are mounted with the usual backlash, and run a short time, using an abrasive with oil. The gear is raised and lowered continuously to bring every part of the pinion tooth into contact. When the operation is complete the gears are put in a test machine and again checked for tooth bearing and sound. This is the final test of the gears before they go into axles. The best gears are sent to repair stock while the balance goes to the axle assembly line to be built into axles. The gears are adjusted and given a final test in the finished axle.

The gears should be cut with a 9-in. cutter because the path of the blades then more nearly intersect the apex of the gear, and give less of the skew gear effect. The pinion should be cut out by the duplex method and the radii of the blades changed so as to give as long a lengthwise bearing as if it had been cut with a 12-in. cutter.

It is doubtful if the spiral bevel gear has had a fair chance up to date. It has been condemned in a great many cases when the gear was not at fault, where conditions surrounding it were such that it could not give satisfactory service.

Quiet Gears Essential

Considerable experimenting has been done with the passenger car gears in an attempt to get a greater degree of quietness. Various experimental sets of gears were made using the same pitch and number of teeth. These sets included different pressure angles, various addendums and dedendums, and various center distances. A large number of experiments were also carried out using ground gears, but in no case was the degree of quietness under load any better than with the standard 20-deg. full-depth tooth.

A decided decrease in sound was obtained by the use of finer pitch gears. Just how far this decrease in pitch can be carried and what degree of quietness can be attained without decreasing the life of the transmission has not be determined.

As our experiments progress, it becomes evident that in order to get the greatest degree of quietness, every effort should be made to increase the number of teeth in contact and improve the profile and tooth spacing. Driving conditions are now demanding two quiet speeds, and it is going to be up to the engineers and gear men to produce them.

The selection of a proper gear steel is quite difficult because there are so many variable factors, such as loads, ratios, pitch, long or stub teeth, and whether the gears are to be used in a passenger car, truck or bus. The three following oil hardening steels are quite generally used: SAE 3250, SAE 5150 and SAE 6150. Of the carburizing steels SAE 2315 and SAE 2512 are often used. The former is a favorite for use in ring gears and pinions.

Heat Treatment

Gears should be heated slow enough for forging so that they will be heated uniformly throughout the cross-section. Optical pyrometers are very useful in determining forging temperatures. Wherever possible we upset our gear forgings, in order to obtain uniform strength in the teeth and eliminate warpage.

With the steels mentioned, heating to 1,550 or 1,575 deg. F., quenching in oil, and then drawing at 1,350 to 1,375 deg. F. will give a Brinell hardness under 217, and a structure which will machine well and leave the gears in a condition such that they will go through the final heat treatment with no warpage. However, the general treatment is an anneal rather than a quench and draw. Heating to 1,525 or 1,550 deg. F. and holding long enough to have all of the gears heated through, and then cooling 50 deg. F. per hour is claimed to have given very good results.

Oil Quenching

A very satisfactory treatment for SAE 2,315 steel is to heat to 1,550 deg. F., holding the gears at the heat for 1½ hr., and air cooling. The gears will be about 170 Brinell hardness. Good results can be obtained from SAE 2,315 steel by quenching it in oil from 1,460 deg. F. This treatment seems to give the highest impact value possible with this steel. The single treatment is also an advantage in that the gears do not warp as much as if a double treatment had been given.

Our ring gears made from this steel are heated in a continuous electric furnace, which gives very uniform results. One of the important aids in getting these results is an inspection of roundness of the bore and for burrs in the bore on the back of the gears before they go into the furnace.

There seems to be considerable controversy in regard to electric furnaces in comparison with cyanide or salt bath treated gears. We believe it is safe to say that the cyanide treated gears will wear better, will be somewhat noisier and have a different sound than the electric furnace treated gears.

The quenching mediums and methods of quenching are also important. For example, if we use the same temperature and rate of heating, and quench one gear in water and one in oil, they will very likely not be of the same size, and one will be warped more than the other. Likewise, if one gear is quenched by a method which has given minimum warpage and another gear is carelessly quenched, the latter gear will be warped more than the former.

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Methods in Small Gear Inspection

By P. W. Rhame
A. C. Spark Plug Co.

PROBABLY the average automotive engineer never realizes the care and accuracy that is put into the small unit, the speedometer. The making of transmission gears has received an enormous amount of attention and development toward accuracy and quietness. These same factors are given constant attention in the making of our speedometers, and a special silent drive is installed in a quiet room for a noise test of the final assembly and the units are held in a case to get resonance.

Our floor inspection system, in the making of gears, has some points that may be of interest. The inspector makes the rounds of all machines every thirty minutes and puts two or three of the last pieces made from each machine into the proper compartment in his tray. The remaining finished work is then set to one side. He goes with these samples to his central gage bench and checks the work visually for finish, and with gages for mesh and size. If the sample parts are passed, the pieces set aside at the machine are dumped into an "O.K." pan. If they were rejected, they go into an "N.G." pan, which is later inspected on all points.

The results of the inspection tour are written on a special form by the inspector, so that there is a complete record of the results obtained of all the machines in the department. The substance of this report is multigraphed and distributed daily to the management and foremen. This report feature serves both as a check and as a means of stimulating interest.

Realizing that gears and worms can be only as accurate as the cutters, machines and gages, we have found it necessary to resort to ground cutters and the use of a lantern projector to check them. Special machines have been designed. Even on these we have had to go to the refinement of keeping small chips from the cutting compound in order to maintain accurate concentricity of the parts. This is done by flowing the cutting compound through a standard oil filter.

The gages for the jobs have gone through a process of evolution in order to meet the demands of accuracy, reliability, speed and simplicity of maintenance. Gages are checked regularly twice a week with hardened master worms and gears. This is done by men who do nothing else but check and set gages. In all cases inspectors have detailed written instructions on what to do and how to do it. These instructions are read regularly and kept up to date. We feel that they are an absolute necessity if uniform standards of rejection are to be maintained. We believe that inspection supervision should always aim to be effective, and should not be content to stop developing systems, methods and equipment to obtain that end.

Inspection of Knight Engine Valves

By J. B. Scott
Yellow Sleeve Valve Engine Works

INASMUCH as there are relatively few manufacturers of Knight engines in the United States, it is believed that a description of the inspection operations involved in the production of the sleeves, which are essential parts of the Knight valve mechanism, may be of some interest to men who are familiar with operations involved in the manufacture of poppet valve engines.

All sleeve castings are normalized to remove casting strains, a car-type annealing furnace being used for this operation. It is our present practice to normalize the sleeves just as they are received from the foundry. The normalizing operation takes place in a 12-hour cycle, the temperature being gradually increased to 1,060 deg. F., which temperature is maintained for a three-hour period. It will be understood that the furnace temperature is always well below the annealing range. As a matter of actual practice, the hardness of the sleeves is only reduced about 1½ points Rockwell in the normalizing operation.

Examination of the sleeve discloses several close tolerances, and the fact that a considerable number of machining operations are involved in finishing the sleeves. Inside and outside diameter are held within 0.0005 in. Sleeves are permitted to taper within the diameter tolerance only. The maximum out-of-round tolerance is 0.004 in. at the upper end of the sleeve and 0.002 in. at the lower end. The distance from the center of the sleeve pin hole to the lower edges of the ports is held within 0.004 in. The width of the ports is held within 0.002 in. The bore of the inner sleeve is honed after grinding.

To maintain a tolerance of 0.004 in. in a length of almost 10 in. requires some care in the control of temperature. These are conditions which are encountered in the milling of the ports. Relatively small temperature changes affect the fixture, cutter arbors, work arbors and the milling machine itself, to a considerable degree in relation to the tolerance which must be maintained in the porting operation. One precaution which is exercised in connection with this operation is to run the machine idle until approximate working temperatures have been reached before the actual operation of porting is started.

THE · FOREMAN'S · ROUND · TABLE

The Foreman's Main Job

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"AL, YOU'RE the champion bunk shooter in this neck of the woods," said Ed as they came out of a foreman's meeting. "Here you've been preaching welfare work and handling the men with fur-lined kid gloves and then you switch into a hard boiled 'drive 'em or bust' foreman in the meeting. You made a hit with the old man, though, perhaps that's what you were after."

"Wrong again, Ed. You jump at conclusions like a trout to a fly. And I don't fancy having even you think that I've changed colors on the foreman question."

"What else can I think, Al, after your answering the old man's question as you did? He asks what is the foreman's real job and little Al comes back with a humdinger—'production at a profit.' You hit the old man's bull's-eye square amidships, Al."

"Sorry you took it that way, Ed. But when you boil it all down what else can the foreman's real job be? If we don't get production at a profit the firm goes broke and we all lose our jobs. I didn't say that was the only job of the foreman and it doesn't mean that he has to be a slave driver. Fact is, that's the best way not to make a profit.

"What I meant, Ed, was that whatever the foreman did has to be considered from the dollar standpoint in the end. It costs money to keep the windows clean, but it costs more money to have them dirty. So we clean 'em and have a nice, light shop and make it pay a profit too. It's the same way with everything else that's worth while. A clean shop pays dividends. In the same way it pays to treat men fairly and give them careful consideration in all things.

"One of the reasons I'm against bawling men out is because it not only isn't careful of the man's feelings, but it doesn't pay. That's why I urged you to forego the satisfaction of telling your man what you thought of him. Instead of thinking of your own satisfaction you've got to keep your eye on the profit end of the business."

"Have I got to stop and think 'profits' all day, when I'm up to my neck in all sorts of things, Al? Can't I just think of my job and let the office worry about profits? That's up to them, isn't it?"

"You don't want to have to think about 'em. The notion wants to be so deep in your alleged mind that you won't have to think about 'em. When you're driving and see a coal truck ahead of you, do you stop to think brakes? 'Course you don't. You jam 'em on without stopping to think at all. That's the way with the profit idea. You've got to soak it away so it will automatically crop up and help you decide on the best thing to do. When the office begins to worry about profits in your department, your job is in danger, Ed."

Is Al right about profit being the most important part to consider?
Or should the office do all the worrying about profits as Ed suggests?
How far can a foreman influence profits in his department?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

How Should Suggestions Be Handled?

AL WAS doing the correct thing in sending Scotty to Williams, the "super," since Al must have known that Scotty's suggestion was a good one. His was the job to analyze the suggestion and to know the man who made the suggestion. Ed must realize that individually we are weak and that progress is only attained by collective efforts.

I believe that every suggestion put forward should have the foreman's approval, even in the case of using the suggestion box. We must agree that if the foreman has been through the merits of a suggestion when it gets to the "super" it will be in a tangible form.

It may have been recognized as good policy in the bygone days for the superintendent to refuse to deal directly with his men, but today the policy will not do. To get the best out of anything, we must give the best. If the superintendent wants to get the best out of his men he must be willing to deal with them directly.

Scotty should be commended for his suggestion if it is desired that he continue with additional suggestions. He will then improve his own mental faculties and be of more value to the company. There are many ways he can be rewarded but the recompense will be more greatly appreciated if the reward is given in the right manner and with the right attitude. Scotty was paid to do the work assigned to his machine, but in using his head to develop new methods he was doing more than was his job. Ideas do not usually come to a man while he is working but after his day's work is over. The appreciation of the management should be extended to him.—C. L. HENRY, *Foreman, England.*

Letting a Man Try His Own Way

MY FIRST thought after reading the conversation between Ed and Al was that if I were working under Ed, I would very shortly start out looking for another job. To my notion, he has an entirely wrong conception of his job as foreman.

Of course it is very commendable in a foreman to know the best way to do every piece of work that comes to his department, but if he is up on his toes as he should be, and has enough dependable workmen with initiative to carry out the work assigned to them, he will be too busy with other things to worry over whether the work is being done just as he dictates.

Whenever I discover a man like Jimmie Johnson, it takes several furrows out of my brow. What a relief it is to simply say, "Jimmie, we want ten of these pieces just as soon as possible," and not have to explain what tools are necessary, which machines to use, which operation comes first, and all the rest of the information which a workman should dig out for himself.

P. H. WHITE.

Getting Information from Catalogs

THE shop man looks upon a catalog from an entirely different viewpoint than the purchasing agent or superintendent. Unfortunately the catalog is often gotten up with the primary and sole object of selling the machine to these executives. The shop man wants many additional features. He wants ready information for quickly specifying replacement parts, preferably by number, so that he can be certain of getting a broken down machine back into operation in the shortest possible time. He wants practical operating information on the special or unusual features or attachments, written in his language. He wants detailed information on the care of the machine, oiling, greasing, and parts subject to extreme wear. He wants to know how often to do these things, so that he can have every chance possible to keep the machine in commission for a maximum period of time.

Text books, generally speaking, give only that general information which a good mechanic should already have at his command. In training apprentices, however, they are mighty helpful. When it comes to special features, and what machine in this day of fast and furious competitive selling does not have them, why, the text book cannot possibly cover them all and seldom attempts to. Then too, a new machine makes its appearance in the market usually years before it gets into the text books, so that in a thoroughly modern shop the greatest dependence by far must be placed on the catalogs.

A well-prepared catalog should sell, operate, service and repair the machine it covers. If it will do all these things, and do them well, it will eventually aid greatly in accomplishing a fifth function—securing repeat orders.—CHARLES E. KIRKBRIDE.

Keeping Machines on the Job

THERE is one important point that makes a big difference, from a maintenance standpoint, in keeping machines on the job and different methods are needed. Whether your product requires skilled or unskilled labor makes a difference on the repair bill. For instance, a plant manufacturing machine tools on a large scale is in a totally different position, as far as

THE · NEXT · TOPIC

Keeping Men Interested in the Job

QUESTIONS

Is it worth while to arouse a man's interest in his work?

If so, what are the best ways of doing it?

How many men in the shop know what is going to become of the parts on which they are working?

THE · FOREMAN'S · ROUND · TABLE

the prevention of breakdowns is concerned, from the ordinary manufacturing shop owing to the highly skilled class of labor employed. As a rule they will understand the construction of their machines and when some detail or part works loose they will make the necessary adjustments themselves for their own good. The unskilled laborer will literally run a machine till it falls apart or until its bearings burn out. In such conditions as the latter periodical inspection is necessary to prevent the occurrence of serious breakdowns.

Each plant, however, should have a maintenance department as centralized as possible and responsible only to the efficiency engineer who should also make a periodical inspection of the whole production plant. He must work in harmony with the heads of all departments, notifying them when he is shutting down this or that machine in time to give them an opportunity to prevent as far as possible the slowing up of production. When the repair has been made the foreman of production should O.K. it before it is considered as satisfactory. While these frequent inspections will keep the operator idle a few minutes each time, the saving will be in hours of loss because of breakdowns.

The average machinist takes better care of the engine of his automobile than he does of the machine on which he earns his living. He knows what this or that automobile repair will cost him apart from the inconvenience. It might be a good plan for the boss to tell his workers in a friendly way the cost of their machines. Probably 95 per cent of the machinists have not the least idea what the cost of machinery really is and I think that if they were taken more into the confidence of the management in these things, better care would result.

My reason for advocating a separate repair department is that if you have both repair and production under one foreman you can never tell what part of your costs is repair and what part is production. You are likely to get a lot of time charged to repair that should be production or vice versa. Instead of a number of foremen each having to provide for replacement and repair, there is but one department responsible. In all repair work in production plants there is frequently nothing to do in one department and too much in another.—ARTHUR SILVESTER.

Picking Assistants

I TOLD the boss that I was going to pick an assistant. He couldn't see the extra expenditure involved until I pointed out to him that having an assistant foreman was a good deal like life insurance. In these days of dodging taxicabs and rushing for the 5:15, a perfectly healthy human being leaves the factory at night and the next day we are taking up a collection for flowers. That's when the expenditure pays dividends.

He raised the question about my training a man to take my own job and I told him that if the assistant could do that he was entitled to it and that I would rather be in the position of having a man ready to step into my shoes so that in case a chance of advancement came along I would not be left out of consideration simply because I couldn't be spared where I was.

After looking over my card index file, I find three men as prospective candidates, Tom, Dick and Harry. Tom is the best mechanic of the three, can handle help as well as the other two but he lacks the fundamental requisite of all, loyalty to myself and to the firm. My card shows that although he has worked for us for ten years he is everlastingly knocking the firm and myself. Dick is a good mechanic and is loyal, but he is "chicken-hearted" and afraid to deal out reprimands when needed because of the fear of losing his reputation as a good fellow. Harry is a good mechanic, loyal and not afraid to censure when necessary, yet he is broad-minded enough to forget an incident and to hold no grudge. He is, above all, not a "yes" man. If he doesn't agree with some of my policies he tells me so and sometimes I convince him that he is wrong and sometimes I change my policy. He is going to be the assistant foreman.—LEON F. SCHAFFERT, *General Foreman.*

How Should Suggestions Be Handled?

SECURING attention for ideas of the workmen is a problem that varies with the type of management at the top. Where the manager thinks that the foreman should know all the best methods and can evolve the best ideas on every subject, it is a great temptation to claim at least a part of the ideas that come to him from his men. For the foreman in such a plant is usually so busy with petty details that he has little time for new ideas.

With foremen of the right kind, suggestions can well go through their hands. But when the foreman and some of his men clash on politics or religion (which should not happen—but does) only a very broad-minded foreman can give his opponent a fair show when it comes to passing on ideas. The foreman can help a new idea by advocating it—and it usually has little chance of adoption if he doesn't approve. So the foreman seems the natural channel through which the ideas can reach the top.

It is seldom wise for a super to deal with the men except through the foreman. After a subject has been taken up the foreman need not be present at all discussions. But he should know all about the idea and how matters stand.

Rewards nearly always stimulate ideas and suggestions. These may be in cash or in some form of recognition such as vacations or other appreciation. One difficulty is to get a reward that fits the case. A stated prize of $5 or $10 is far from satisfactory as some ideas are worth less—others very much more. Making the reward fit the real value of the idea is a difficult problem.

Foremen's meetings will help in almost any shop. They are highly successful in most cases. Where they are not there is something wrong with the organization.

—WM. TRASK, *Foreman.*

Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Magazine Feed for a Press

BY J. E. FENNO

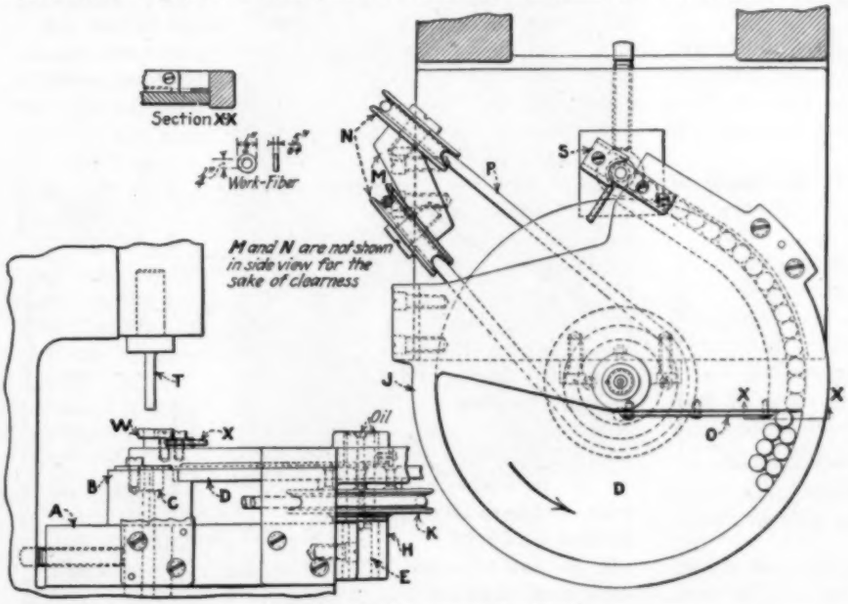
Some time ago we received an order for a very large quantity of small fiber washers. Having on hand a lot of fiber blanks that had been punched out of other work, and, since they were of the same diameter and thickness as the washers were to be, it was necessary only to punch holes in them to convert them into washers. Otherwise they were merely scrap.

Since the material cost us nothing, and the order for the washers was a large one, we felt warranted in tooling up for production. Consequently, we designed and built the magazine feed shown in the illustration and attached it to one of our bench presses.

The plate *A*, attached to the bed of the press, carries the die-holder *B* and the die *C*. The revolving disk *D* is fastened to the shaft *E*, which has bearings in the brackets *H* and *J*, both being attached to the plate *A*. The grooved pulley *K* is keyed to the shaft *E*. The bracket *J* has a milled groove, slightly wider than the diameter of the blanks to be punched. The groove forms a rectangular cross-section with the disk *D*, through which the blanks pass freely. The band around the disk keeps the blanks in place.

The bracket *M* is attached to the plate *A*, and carries the two idler pulleys *N*. The fiber strip *O* is set close to the disk *D*, and keeps the blanks grouped at the mouth of the groove. The disk *D* revolves in the direction of the arrow, receiving its motion from the press countershaft through the round belt *P*. The blanks are poured on the disk and are carried by friction to the groove, the operator simply guiding the supply with a rod.

In operation, the blanks being carried through, the first one is forced against the V-plate *S*, which locates it concentrically with the punch *T*. After the hole has been punched the return stroke carries the washer up until it is disengaged from the punch by the stripper *W*. At this point, a blast of air through the tube *X* (operated by a button valve not shown) blows the finished washer from the die. During this time another blank has been brought along and punched, thus completing the cycle. The punch is slightly tapered so that it holds the washer until the stripper removes it. The press was run at 90 strokes per minute.



Details of the magazine feed

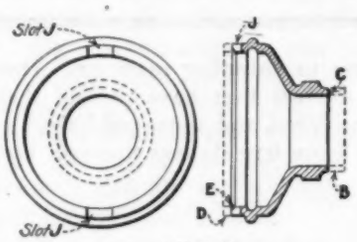
Using Turret Roller-Supports Saves Two Operations

BY HOWARD S. EVANS

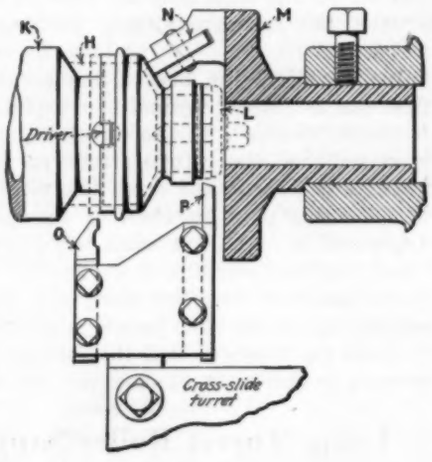
The work shown at *A* is made of drawn brass and was originally machined in three operations on a turret lathe. In the first operation it was held on an arbor and turned and formed to the shape shown. In the second operation, it was held by the large end in soft jaws by the inside, the end *B* was cut off and the edges at *C* were rounded. In the third operation, a plug was inserted in the small end to prevent distortion, and the work was held in soft jaws by the small finished ring on the outside, while the end *D* was trimmed and the inner edge chamfered at *E* to remove the burr caused by cutting off. The original method required three machine set-ups to complete the work, although the second and third operations were very rapid. In order to eliminate these two operations, another scheme was put into effect with good results so that the entire job was completed in one setting. As originally made for the first operation, the nose piece was in the form shown by the dotted lines *H*, but it was cut down to allow room for the tool *O* to pass by the end of the work while cutting it off. The work is driven through a slot in the end of *J*, by a driver in the nose piece *K*. A screw and slotted

washer at *L* allow the piece to be quickly set-up and removed from the arbor.

Since it was out of the question to cut off the small end of the work and round the edges while the washer *L* was in place, a roller support *M* mounted on the turret was brought up when facing, and three narrow rolls, one of which is shown at *N*, bear against the angular portion of the piece and keep it firmly against the shoulder on the arbor. The turret is of course locked in place at this time. The tools *O* and *P*, in a special holder in the cross-slide turret, are used to cut off both ends of the work, and in addition the tool *O* removes the inside burr caused by cutting off. The turret is then moved back and indexed, and a simple forming tool is used to round the corner of the work at *C*. These little improvements brought about a gain of nearly 100 per cent in production and reduced the setting-up time very materially. In addition, it tied up only one machine instead of three, as had been the case previously.



Work A



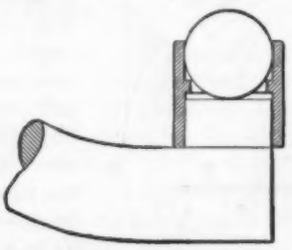
Turret roller-support

A Ball Attachment for the Micrometer

BY E. J. HURLEY

For measuring the wall thickness of tubing, bushings, etc., or testing bushings for concentricity, the ordinary micrometer equipped with a flat anvil is useless, since the anvil contacts with the curved part of the work at the edges only.

A ball of known diameter attached to the anvil of the micrometer, as shown enlarged in the illustration, will allow such measurements to be taken. Due allowance, of course, must be made for the diameter of the ball when taking the reading. The ball holder can be made by drilling a piece of steel from each end, leaving a shoulder to prevent the ball from falling out at the bottom when the attachment is not in use. To prevent the ball from falling out of the top, the holder, which should be long enough to come above the center of the ball, is slightly peened inwardly.

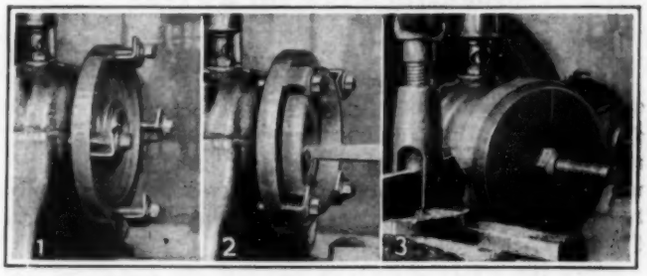

A convenient attachment for the micrometer

Fixtures for Holding Valve-Seat Bushings

BY ERNEST L. LUCAS

From time to time the shop man is called upon to turn and bore thin brass or bronze valve-seat bushings. On account of the thin walls, it is hard to hold these rings in a chuck, due to the distortion by jaw pressure. I had several valves of the balanced type to rebush, and made the set of fixtures, shown in the illustrations from scrap castings.

A stepped-faceplate mounted on the lathe spindle with screws and clamps to hold the rings is shown in Fig. 1. The casting was bored and threaded to fit the spindle, mounted, turned, faced, and three recesses cut on the face to hold the rings. Four holes were drilled and tapped for capscrews. The clamps were made from ¾ x 1¼-in. mild steel. Fig. 2 shows a ring mounted in the fixture for boring and seat beveling.



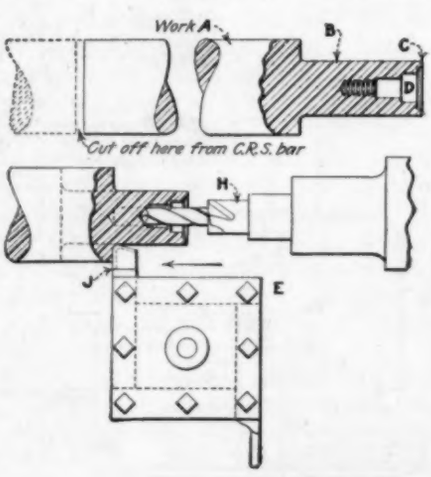
Figs. 1 and 2—Fixture for boring valve seat bushings. Fig. 3—Fixture for turning valve seat bushings

A self-centering fixture for turning the rings to fit the valve bodies is shown in Fig. 3. A casting was fitted to the lathe spindle, and a 45-deg. face turned on it having a maximum diameter slightly larger than the bore of the largest ring. A companion plate is held against the rings by a stud through the spindle.

Combined Drilling, Counterboring and Turning Saves Time

BY HENRY T. DOWNS

In turning bar stock, it is quite usual to use either a box tool or a roller turner. The box tool can be, and often is, combined with a drilling or counterboring operation, but with a roller turner the combination does not work as well. Also, when a great deal of stock reduction is required, the ordinary box tool is not heavy enough for the job. A case in point is shown in the illustration, the work *A* being bar stock, 2½ in. in diameter, and is to be turned to 1½ in. at *B* and the corner at *C* is to be rounded.



Tools arranged for combined cuts

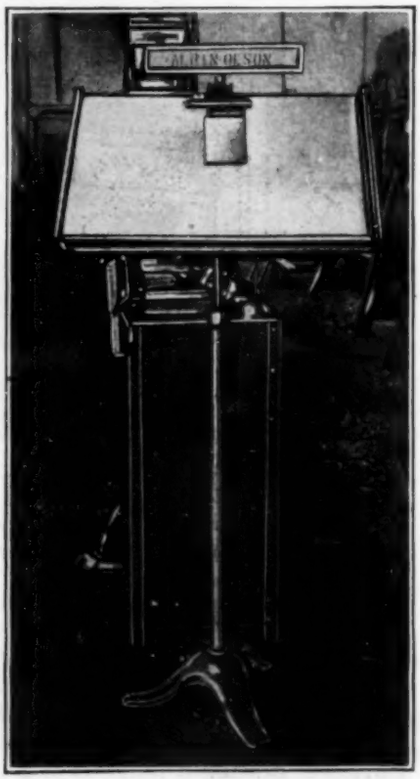
Inside work is to be done at *D*. The work was done while the bar was held short up in the collet and before pushing it forward to cut it off at the dotted line. As originally done the diameter *B* was turned with a roller turner and no other tools could be used while it was at work.

By making a change in the method of machining, as shown at *E*, it was found possible to use a combination drill and counterbore *H* in the turret, while turning the diameter *B* with a tool *J* in the turret holder of the cross-slide carriage. By using a feed of 0.005 in. per revolution, and a speed of 90 ft. per minute for turning, no trouble was found in drilling and turning at the same time, nor was the work difficult to hold within the required limits. The tools were timed so that the turning was completed at just about the same time as the drilling and counterboring, leaving the tapping and corner rounding to be done separately. Of course, the cutting off operation was done by itself. The saving in time by combining the operations mentioned effected an increase in production of about 80 per cent.

Recognizing the Individuality of the Workmen

By J. Madden

Presidents and other high officials have their names on the doors of their offices. Lesser officials are likely to have theirs on brass plates in conspicuous positions on their desks. Even clerks are labeled. All of that is as it should be, in the interests of letting everyone know the name of the man with whom he is dealing, where to find the man he is looking for, and so on. It seems that the displaying of men's names might well be carried into many shops, as is done by the Axelson Machine Co., Los Angeles, Calif. Each man at machine or bench has a stand like the one illustrated, that carries his name at the top. The bracket supporting the name card can be swiveled to make the name readable from the aisle, regardless of the position of the stand.



Workman's stand

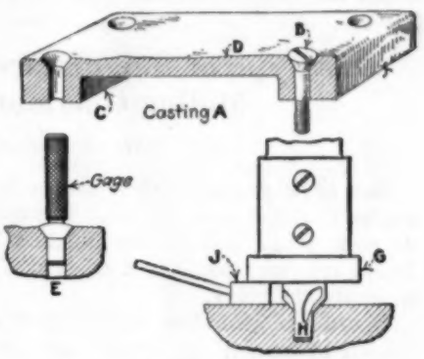
The board is equipped with a clamp for holding shop orders, lot tickets, blueprints, and so on. It is large enough to permit a print of fair size to be spread out, and raised strips at the bottom and sides act as retainers.

The stand is a convenience for the workman, always furnishing him a desk. It is also a guide to messengers and laborers. The addition of the name bracket recognizes his individuality. Almost every shop man has some clerical work and needs something to serve as a desk. Certainly every shop man has individuality and much good may result from stimulating his pride by displaying his name.

Countersinking to Uniform Depth from the Face of Rough Casting

By John D. Alexander

It is difficult to countersink holes uniformly in a rough casting like that shown at *A*. When a nice product is wanted, having oval head screws countersunk as at *B*, and when the work is located from a finished surface *C* there are certain to be variations in depth if the stop collar on the drilling machine is used. The surface *D* is uneven, and one hole may be countersunk all right while the next will be too deep, or not deep enough. Using a gage like that shown at *E* to determine the depth is a slow process and the operator frequently has to try it twice or three times in the same hole to get a good job.



Gage for countersinking

A good way to obtain uniform work with little waste of time, is to make an adjustable sleeve *G* of hardened steel, and slip it over the countersink *H* as shown. Then make a size block, say, ½ in. thick, with a long pinhandle as at *J*. After adjusting the sleeve to the proper height, the countersink can be brought down until the flange on the sleeve strikes the block *J*, which will give a uniform depth from the rough face of the casting.

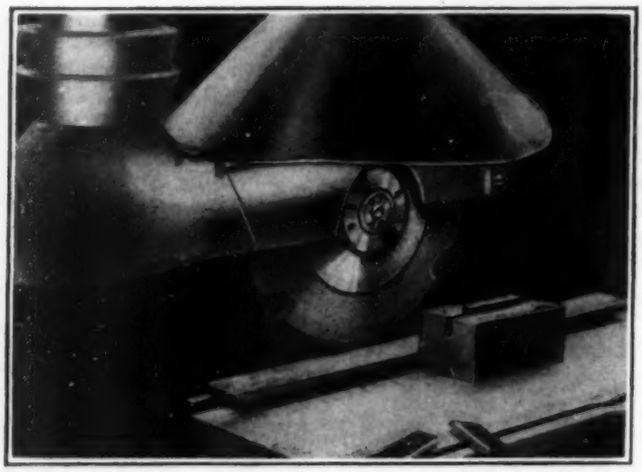
Cool Grinding With a Notched Wheel

By Henry Densmore

In a toolroom where there are many hardened parts of comparatively thin section to be ground, difficulty was experienced because of the wheel overheating the work and causing the temper to be drawn. To overcome the trouble the grinding wheel was notched, as can be seen in the illustration, at four points on its periphery, approximately 90 deg. apart.

The notching was done by holding the wheel against a coarse and somewhat hard-bonded snagging wheel, grinding away the material and leaving the notches as shown. The life of the wheel does not appear to be lessened by having that much of the surface cut away.

A wheel notched in this way will run much cooler than will one having a full circumference, though this



A wheel notched to grind cool

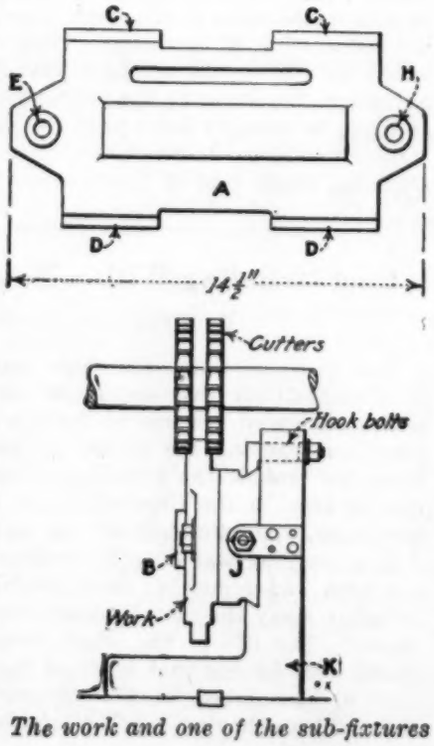
scheme cannot, of course, be considered to be a substitute for a liquid coolant. However, the majority of toolroom work is probably ground dry, and toolmakers who have been bothered by having the work "draw" under the wheel would do well to try this scheme.

One Type of Sub-Fixture for Three Milling Operations

BY CHARLES PARKER

The casting shown at *A* has a finished pad *B*, and guides *C* and *D* on each side. The relation of the guides to each other and to the finished pad, is important. There are two rough cored holes at *E* and *H* from which to locate the work.

In order to avoid the possibility of accumulated errors, caused by re-setting, and to keep production up to the maximum, a novel arrangement was employed. Four identical sub-fixtures *J* and three special angle plates were used. Similar angle plates were mounted on three milling machines and the cutters were suitably arranged. No. 1, to face the pad *B*; No. 2, to mill cut *C*; and No. 3, to mill cut *D*. The work being located and clamped on the fixture *J*, which is set against the angle plate *K*, the hook bolts are tightened and machine is started. The operator loads the other fixtures, and when No. 1 machine has finished its cut, he transfers that fixture to No. 2 machine and so forth, soon having all three machines working on three different cuts.



The work and one of the sub-fixtures

Since each cut takes about the same length of time, the operator is able to transfer the fixtures from one machine to another with very little loss of time. Also, one fixture is always loaded for No. 1 machine.

A Radius Planing Attachment

BY MICHAEL KELLY

The attachment for planing curved work, shown in the illustrations has been in use in the Schenectady plant of the General Electric Co. for a number of years.

Referring to Fig. 1, the inner end of the arm *A* is attached to the bed of the planer, and is used for locating and holding the pivot upon which the radius arm *B* swivels. Holes in both arms provide means for changing the location of the pivot, so that work of various radii can be planed.

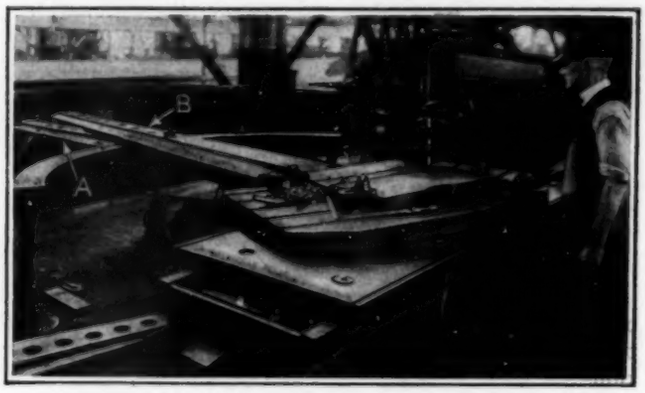


Fig. 1—Attachment for planing curved work

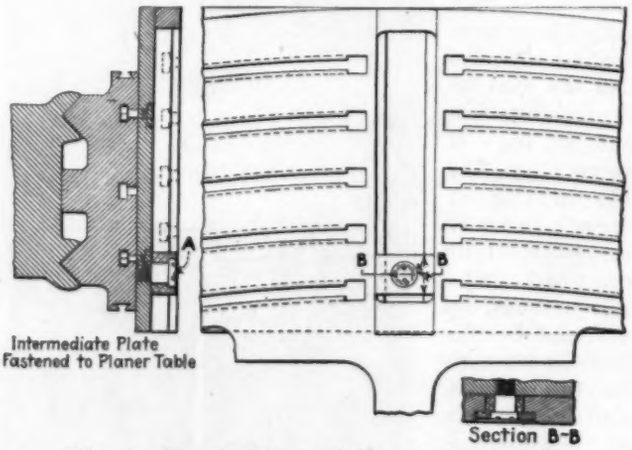


Fig. 2—Construction of the auxiliary table

The radius arm *B* is attached to the auxiliary or swinging work-table, mounted upon an intermediate plate fastened to the planer table. The construction of the auxiliary table is shown in Fig. 2. When the planer is in operation it both swings and slides upon the pivot *A* (attached to the intermediate plate), the combined movement causing it to travel in a circular path.

As the radius arm *B*, Fig. 1, swivels upon its pivot, its outer end slides on top of the quadrant at the far side of the planer. The jack under the quadrant supports the outer end of the stationary arm *A* and holds it against the under side of the quadrant.

Roller Bearing Mounting Methods

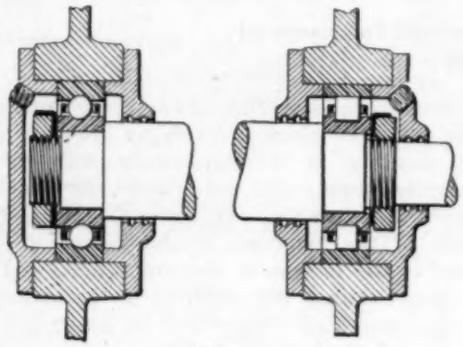


Fig.1

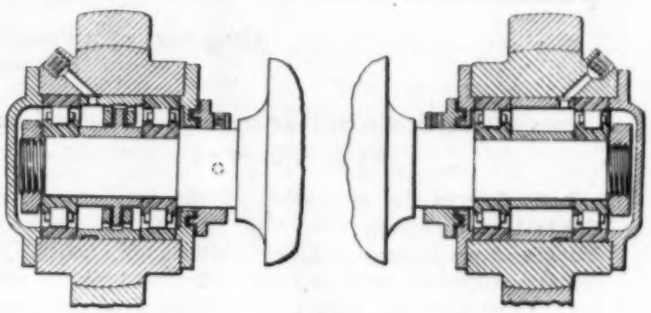


Fig.2

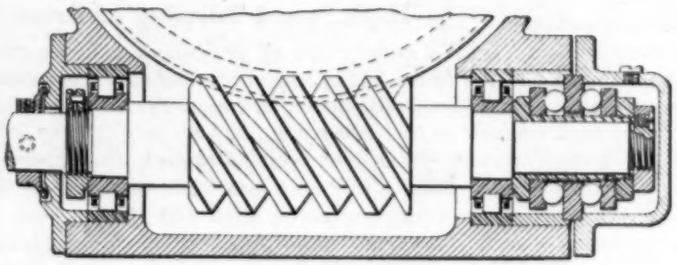


Fig.3

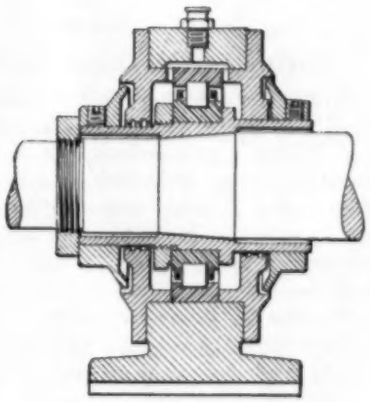


Fig.4

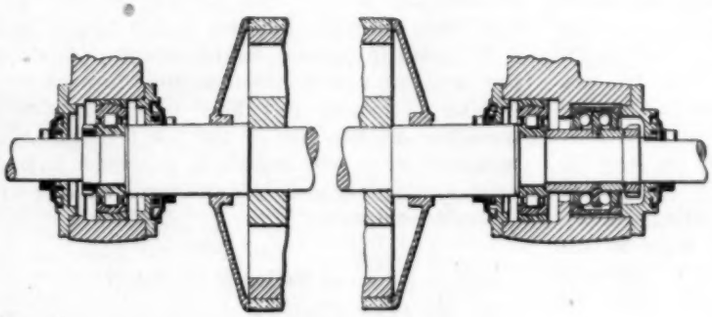


Fig.5

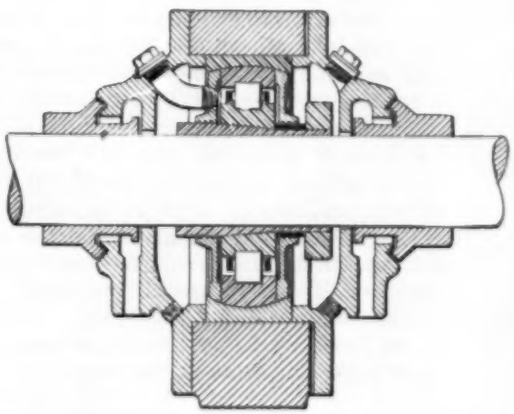


Fig.6

Fig. 1—Electric motor mounting using roller bearing at drive end and ball bearing at opposite end to carry thrust loads. Fig. 2—Self-aligning housings with two roller bearings in each; thrust taken on flanges in left-hand housing. Fig. 3—Wormshaft application using double ball-thrust bearing. Fig. 4—Self-contained roller bearing mounted on tapered sleeve where frequent removal is necessary. Fig. 5—Self-aligning roller bearings used with double self-aligning thrust bearing. Fig. 6—Self-aligning bearing with adapter sleeve and swivelling side cover plates, for use where water and dirt may be encountered

For the information given we are indebted to the Norma-Hoffmann Bearings Corporation

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Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Preventing Scale in Hardening—Discussion

By J. S. Browne

Referring to the discussion of the subject of scale elimination on page 258, Vol. 65, of the *American Machinist* we have found the addition of about 5 per cent of sulphuric acid to the hardening bath to work very effectively in cleaning any scale from the steel pieces. This, of course, applies only to articles quenched in a water bath, and they must be washed thoroughly after removing from the quench.

Caring for Machines in the Small Shop

Q. We have a shop which employs only 20 men and boys, but which has a considerable outlay in machines, line shafting, and motors. It has been our practice to have the oiling of shafting and overhead countershafts done every Monday morning by one of the boys, each taking turns at the job. The machines are oiled by the mechanics using them. During the last year we have had several exasperating tie-ups, which our foreman attributes to improper oiling. We have never had a millwright since we have no other use for one. Can you tell us a good method of controlling the oiling problem?

A. Your trouble, apparently, is that you have not been treating the care of your machines as a serious thing, and this is quite a common fault in small shops. The oiling should be taken out of the hands of the boys, and given to one of your best all-around mechanics. Let him take all day on Monday if necessary, and see that each machine is properly lubricated as well as the overhead shafting. It is not enough to leave the machine oiling to the operators of the machines in a general job shop, as it is then nobody's business in particular. Moreover, the mechanics should not have to stop the orderly progress of work to do oiling.

If a capable man is given the job of oiling, he will also watch out for loose nuts and bolts, belts in bad condition, and other conditions where a little attention in time may save a breakdown. The millwright's job is not boy's work, but should be considered one of the most important jobs in the shop.

Corrosion on Welded Parts

Q. We have been welding cast-iron heads to the ends of a short length of seamless steel tubing, using a cast-iron rod and the oxy-acetylene process. After several weeks, or sometimes months, a sort of corrosion appears at the welds, swelling up and entirely destroying the paint. How can this be overcome?

A. The corrosion appearing on the weld is probably due to an oxide that hydrates in the air. It is possible that a black oxide is formed in the welding operation, which gradually changes to a red oxide, at the same time increasing in volume and swelling the paint. This action will take place through an ordinary paint.

By washing in a hydrochloric acid solution and rinsing thoroughly you can remove the black oxide and prevent the trouble. However, oxides are formed because of the exposure of the heated metals to the air and to the oxygen of the torch, and for this reason you should adjust the torch to a "reducing" flame so that any excess of oxygen will be consumed. You are actually not performing a true welding operation on the cast-iron and steel, since you do not melt the steel. You are likely to get better results by using a bronze rod on these dissimilar metals.

High Speed Turning of Brass

Q. We have a job of producing a large quantity of round brass knobs having turned surfaces ranging from ½ to ⅞ in. in diameter. We have speeded up a hand screw machine to 1,000 r.p.m., but are not getting satisfactory service from our tools, although this speed gives us only about 250 ft. per min. cutting speed on the largest diameter as compared with 150 ft. per min. which we have been employing for soft steel. How are results obtained with the higher cutting speeds obtained for brass?

A. We presume from your comparison with steel cutting that you are using high-speed steel tools. You will get better results on brass with ordinary carbon tool steel. You should be able to obtain cutting speed considerably higher than 250 ft. per min. with carbon steel tools on brass, but you should have a machine that is designed to operate at this speed. If you are speeding up a heavy slow-speed machine to work on the rapid cutting of brass, you may expect trouble with the machine. If the size of the job does not warrant the purchase of a new machine, it would undoubtedly be more economical to sublet the contract to a firm having suitable equipment.

Silicon in Steel

Q. We have a job of producing a large quantity of of silicon in steel is controlled, and what are the advantages of silicon in steel?

A. The percentage of silicon in steel can be governed within close limits by the use of ferro-silicon alloys added to the molten steel in proper quantities. These ferro-silicon alloys contain a very high percentage of silicon.

While silicon is sometimes classified as a metal, it properly belongs to the group of non-metallic elements that show metallic properties under certain conditions. One of its chief values in steel is as a deoxidizer. It also increases the strength and hardness of steel, but has the disadvantage of decreasing ductility. Silicon increases the electrical resistance of steel, and high silicon steels are used for the cores of electro-magnets.

Technical Abstracts

Making Elliptical Springs

The first consideration in making springs should be quality. Without quality, regardless of methods and practices, they will fail. Quality is obtainable only by using a grade of steel suitable for this special purpose, good workmanship in handling, and above all, the correct method of heat-treatment.

It is strictly up to the forge-shop foreman to see and know that good workmanship and proper heat-treatment is applied. The old slip-shod method of heating plates for setting must be abandoned, and furnaces must be constructed so that the fire will not impinge on the steel. Temperatures above 1,675 deg. F. should not be permitted for setting plates to the desired radius.

In repairing springs it is the better plan to cut the bands off, and make and apply new bands. All bands should be applied by hydraulic pressure. A mistake usually made is to cool the bands in water after pressing them on. All springs should be tested after the band is on.—J. B. May in *Railway Mechanical Engineer*, Sept., 1926, p. 564.

Making a Standard of Planeness

At the Bureau of Standards three disks of clear fused quartz, about 10 in. in diameter by 1¼ in. in thickness, have been ground, lapped and polished to produce standards of planeness that are accurate to less than two ten-millionths of an inch. They are sufficiently accurate to meet any demands of laboratory measurement and will be valuable permanent standards if they retain their shape. The disks were rough ground in the Optical Shop and then ground on each other with three successive grades of carborundum. Polishing was done with rouge suspended in water and applied by means of a brush to avoid grit. The polisher was a ⅛ in. layer of pitch spread on a 9-in. plate and checkered with grooves ¾ in. apart. Final testing by means of a combination of lens and mirror showed that the planeness achieved by the man who did the grinding and polishing was as close to perfection as the laboratory could measure.—C. A. Skinner in *General Electric Review*, August, 1926, p. 528.

Battered Rail Joints Built Up by Welding

Railroads are finding it economical to repair the battered and chipped rail joints by building them up by welding. Either the gas torch or the electric arc can be used. Formerly the only way to recondition rails was to cut off the ends or to reroll them. In either case costly handling was necessary.

Roads using the process report that the welding costs, on an average, $1.48 per joint and that the life of the rails is increased from 25 to 30 per cent, also that the operation of the rolling stock is much smoother.

It was at first thought that the heat due to welding might injure the rails and cause breakage, but reports from several roads state that no failures have resulted from that cause.—*Railway Engineering and Maintenance*, September, 1926, p. 350.

Pacific Type Locomotives for the Reading

The Philadelphia & Reading Ry. has recently placed in service five Baldwin Pacific type locomotives equipped with Wooten-type fireboxes. They are to be used for hauling heavy passenger trains in exceptionally fast service, reaching, at times, 80 m.p.h. for a 30-mile run.

The weight of each engine is 306,360 lb., of which 192,540 lb. is on the drivers, 50,160 lb. on the engine truck and 61,660 lb. on the trailing truck. The tender weighs 189,400 lb. when loaded.

The cylinders are 25x28 in. and the working pressure is 230 lb. The maximum tractive force is 42,800 lb. The valves are of the piston type and are actuated by the Walschaert valve gear.

The boiler has a total evaporative heating surface of 3,045 sq.ft. The super heating surface is 745 sq.ft. The fuel is a mixture of anthracite and bituminous coals.

The driving wheels are 80 in. in diameter. The engine wheelbase is 35 ft. 11 in., and the total wheelbase of engine and tender is 72 ft. 2¼ in. Three of the locomotives are equipped for automatic train control.—*Railway Age*, September 11, 1926, p. 461.

Vibration Recorder

An electrical vibration recorder has been developed to measure mechanical vibrations that are not shown on ordinary indicating devices because of inaccessible location. Vibrations as small as 0.0005 or 0.0010 in. have been measured on the periphery of a turbine wheel rotating at 1,800 r.p.m. in a steel casing. This was done even when the wheel was exposed to the steam heat and moisture of the turbine. The whipping of rotating shafts has also been measured.

The principle of the instrument is in a bridge circuit to detect magnetic flux changes caused by the vibrations. It is claimed that a change in the air gap between the core and the magnetic material of 0.001 in. will produce a deflection on the vibrator of the instrument of from 2 to 5mm. The instrument is useful for measuring and recording small mechanical movements.—A. V. Mershon, in *Journal of the A. I. E. E.*, Sept., 1926, p. 820.

Increasing Belt Efficiency

All leather belts are full of joints when they come from the manufacturer, but they are so well cemented that they are seldom thought of as having joints. In making a belt endless, the joint should be made in the same manner as the joints already put in by the manufacturer.

In order that belts may do their best they must be pliable laterally as well as longitudinally. Intimate contact of the belt with the pulley is the secret of sliplessness. The endless belt is best because it is pliable in all directions, and is also smooth and noiseless in running.

The best laced joint is that one which most nearly approaches the cemented joint. If 20 per cent of the cross section of a belt is cut away for the lacing holes, the efficiency of the joint cannot be higher than 80 per cent. Furthermore, rawhide joints are bulky and stiff, and as they pass over the pulley they raise a portion of the belt and destroy the intimate contact.

Compared with the rawhide joint the wire lacing is almost ideal, and as regards pliability metal lacings are continually growing better. If the efficiency of an endless belt is rated at 100 per cent, then a metal laced belt may be taken as 95 per cent, and a rawhide laced belt at only 80 per cent. Thus fasteners, usually considered a "small item," affect the ultimate cost of belting to a very large extent. Too little attention is given the factor of belt lacing.—*Pit and Quarry*, Sept. 15, p. 68.

Wage Payment and Bonus Systems

Of all the schemes that have been put into effect for stimulating production, the one most in favor is the piece work plan, provided the men are given what they call a "square deal;" that is, when they have succeeded in bringing their earnings up to a certain point, the management must not take steps to cut piece-rates. In years gone by, when the foremen used to set the rates in their own departments, the rates often bore no relation to the shortest time that should have been taken to do the job.

This is still true where no effort is made to study the job before setting the rate. If, however, the job is studied intelligently by someone familiar with the work, there is no reason why rates cannot be established in a fair manner and guaranteed against being cut, for a period of time, at least. Guaranteed piece-rates establish confidence between the management and the men, and the actual production comes closer to what the ideal production ought to be.—J. Seton Gray in September *Machinery*, p. 30.

American Machinist

KENNETH H. CONDIT AND FRED H. COLVIN
Editors

Established 1877

Paying for Responsibility

MANY shop managers do not seem to realize the value to them of the foremen's share in the greater responsibilities that are being added to the shop departments with the growth of plants, the increase in the use of expensive automatic machinery, and the more complicated labor conditions. The shop manager who makes a heavy investment in tangible property would never think of leaving it unprotected against loss by fire or other physical hazards, and the annual payment for such protection is sometimes a very considerable sum in proportion to the risk involved.

But how much is paid for the insurance given by the capable foreman? If the judgment of the shop manager has been good, he has picked foremen in whose hands he is willing to trust his expensive machinery, and through whose abilities he feels serious troubles with personnel will be avoided. The shop manager knows that a good foreman will save machine breakdowns and labor turnovers that would cost him large sums. But all managers apparently do not realize that such ability and devotion to shop interests constitute an insurance that should be paid for in addition to the productive work that the foreman does. The capable foreman is an asset worth insuring. His salary should be commensurate.

Progress in Plating

NOW that it has been demonstrated that chromium plating can be done commercially, it ought to be but a matter of a short time before it is developed into an industry of far reaching proportions. One automobile company has already taken it up seriously. A chromium plated radiator is claimed to be rust proof, and will resume its original polish when the dirt is simply wiped off.

What happened in the nickel plating industry may more than repeat itself with chromium plating. The plating of nickel on other metals was done successfully in 1843, but due to the high cost and the difficulties in obtaining pure nickel it was not until 1870 that nickel plating was commercially established. Once started as an industry, however, its spread was rapid, and its use grew to great proportions.

A somewhat similar condition now presents itself with chromium. The plating of chromium on other metals was tried many years ago, but it was only within the last three years that real commercial results were obtained. Chromium plate has many advantages over nickel plate as a protection against corrosion and for giving a good wear-resisting surface. It is even claimed that the bluish-white luster of chromium plate is preferable to nickel for machine parts. The field for chromium as a rust-proof and wear-resisting plating material should be unlimited.

What's in a Name?

HE'S a rare man who doesn't take some pride in seeing his name on the glass door. Pass down from president to shipping clerk—most of them are labeled.

Then why not the man in the shop? If it's a distinction to run the biggest boring mill, or the newest lathe, or a precision machine, it can affect a man's pride only in the right direction to have his name somewhere on the job so that the whole shop will know he is the man.

As told in another part of this issue, a shop on the Pacific coast has adopted the plan of furnishing each man with a portable stand carrying his name at the top. The stand is virtually a desk and is thoroughly practical. Any man can be located without trouble, the time of messengers is saved, and materials are never delivered to the wrong person.

Proper Background for Work

MOST of us have experienced many times the advantage of holding a straight-edge on the work in such a manner that a patch of sky or other bright area affords a satisfactory background. Most of us very often use this expedient to aid vision. Still why are proper backgrounds for work so seldom provided? Here a group of men may be making, assembling, or adjusting fine parts day after day with just the soiled floor or bench, strewn with tools, for a background. There a large number of operators day after day may be stringing fine wires on delicate parts without any attention to the background. In every plant many are continuously working under a handicap due to a lack of attention to simple details of lighting and vision. Sometimes a dark background is best; sometimes a light one is preferable. Delicate visual problems have been solved by providing a background of maximum blackness by viewing the fine details against an aperture in a velvet-lined box or bag. Compared with this, black cloth or paint is bright. In other cases diffusing glass, artificially illuminated, has provided a desirable bright ground. Between these extremes exist a great range of brightness. In every work-place attention to background is likely to be profitable.

Shop Equipment News

Cincinnati-Bickford "Super-Service" Radial Drilling Machines 5- and 6-Foot

Many departures from the usual practices in design are found in the 5- and 6-ft. "Super-Service" radials now being marketed by the Cincinnati-Bickford Tool Co., Oakley, Cincinnati, Ohio, and illustrated in Figs. 1 and 2. The features include:

All speeds in the head, 36 in number.

Power rapid traverse.

Roller bearings on important parts, including the spindle.

Automatic oiling, making use of the Purolator oil filter.

Eighteen feeds, including leads for pipe taps.

All speed and feed changes made by selective, sliding gears.

All shafts have multiple integral keys.

Power column-clamping, operating from the head.

Spindle with six integral keys.

Adjustable spindle counterbalance.

A depth gage arranged to compensate for the drill point.

Head square-gibbed to the arm.

Single-lever arm control.

Safety nut to sustain arm if elevating nut fails.

Safety grip to prevent dropping of spindle should counterbalance chain break.

Entire base of box section.

A single motor for driving the spindle, elevating the arm and for power rapid traverse. The motor is of the constant-speed type and may be for either alternating or direct current.

The standard equipment on the machine includes power rapid traverse, power column-clamping (choice of electric or air), the cutting-lubricant system, a box-type work table, and complete wiring. When sold as a belt-driven machine a roller-bearing countershaft is furnished.

Incidental to the features enumerated are other developments in design: The spindle, spindle sleeve and rack pinion are all of the same material, and the feed rack is cut integral with the spindle sleeve. A positive interlock is provided for arm clamping and elevating, both of which are controlled by a single lever. Power for raising and lowering the arm is taken from the arm shaft. Wiring is run from the motor to the top of the column and down through the column to an opening in the base of the machine; thus the machine is shipped completely wired. A built-in pump, submerged to make priming unnecessary, supplies oil to the mechanism within the head. Teeth of gears that run at peripheral speeds of more than 1,000 ft. per minute are ground. The feed mechanism is a unit, replaceable as such.

All driving power is taken from the arm shaft. Between the motor and the arm shaft any one of five sets of gears may be used to give a corresponding constant speed to the shaft. In raising and lowering the arm, power is taken from the arm shaft, through two friction clutches, to the elevating nut. The control is by means of two cranks and a link, moved by the control lever. The nut revolves; the screw is stationary. Jogging is practicable.

The spindle is driven by friction clutches, and the rapid traverse mechanism by belt from the constant-speed arm shaft. Control of the rapid traverse is directional and the handwheel used in hand traversing does not revolve when power traverse is being used. The feed is driven from the spindle by means of a pair of spur gears; hence the power-feed mechanism is inoperative when the

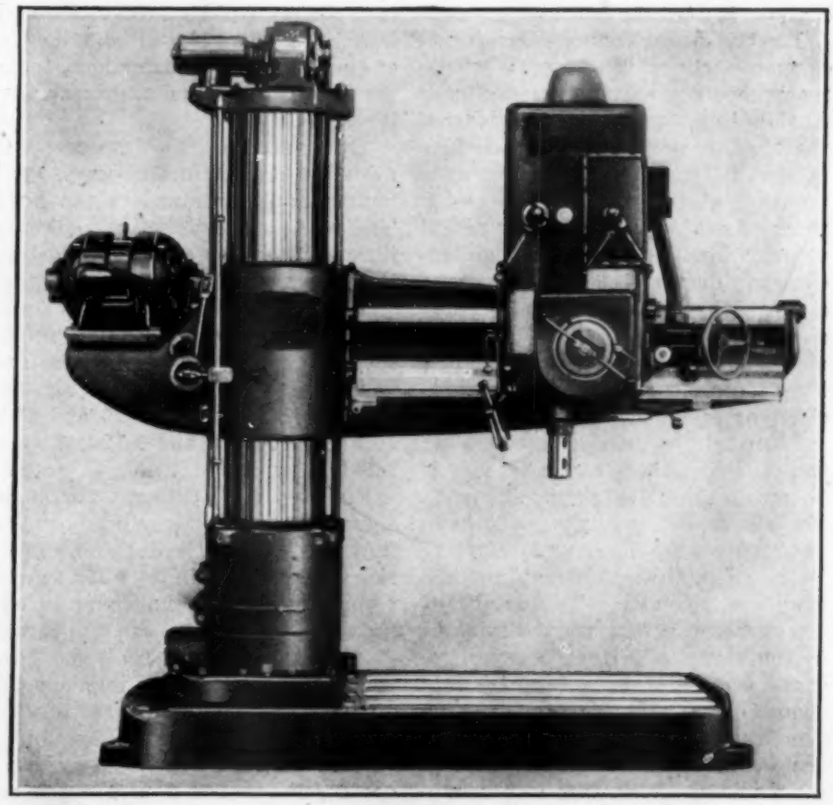


Fig. 1—Cincinnati-Bickford 5-Ft. "Super-Service" Radial Drilling Machine, 5 Ft.

Shop Equipment News

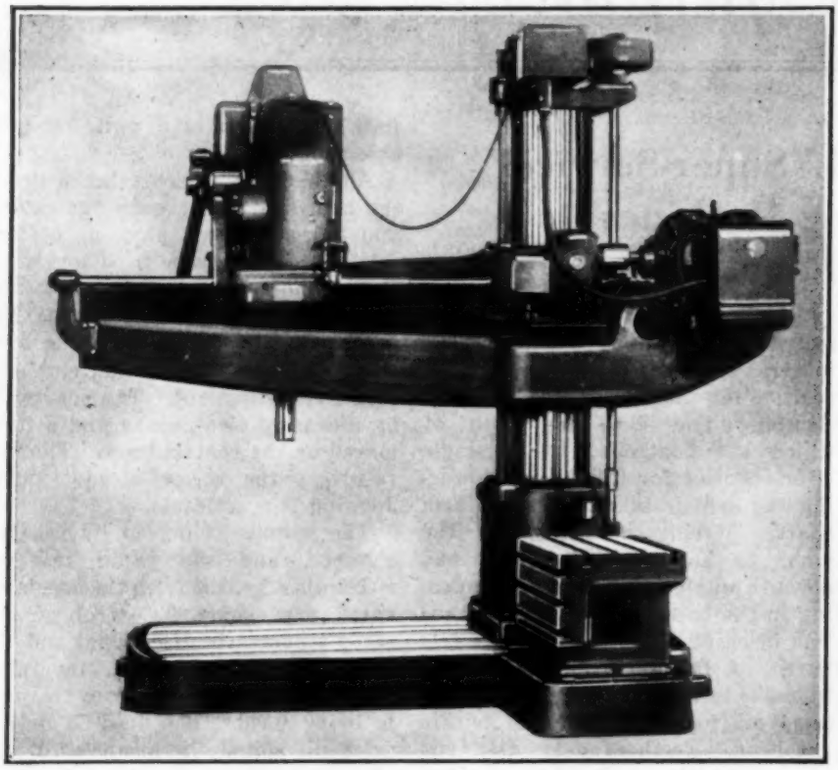


Fig. 2—Rear view of the 5-ft. mach

motion of the spindle is stopped.

Electric power column-clamping is accomplished by means of a torque motor mounted on top of the column. Push-button control, operated from the head, is provided. The winding action of the motor armature is transmitted through a worm and a worm-wheel segment to a vertical shaft, which, by operating an eccentric, draws the sleeve tight against the column. The vertical shaft turns through an angle of about 30 deg. The hand-clamping lever does not move when power-clamping is employed.

When air is used for clamping, the double-acting air cylinder is housed in the driving-motor support. The air valve is actuated by a lever mounted on the head and traveling on a splined shaft extending the length of the arm. The details of the clamping action are the same as in the electric, in that the vertical shaft is caused to rotate through about 30 deg. When motor drive on arm is used, as shown, slip-ring connectors are provided in the base of the machine. When air arm clamping is employed, a swivel air connection is used in the base. The arm can, therefore, be swung through 360 degrees, and if desired, a double-end base can be used, without interfering with electric or air connections.

Thirty-six spindle speeds are available, and all of the gears, 17 in number, are contained in the head. The speeds are selective, obtained through sliding gears controlled by three levers. The range is 60 to 1 with a maximum speed of 1,415 r.p.m. Depending upon the intake speed being used, the minimum and maximum spindle speeds are, in revolutions per minute, 15 and 912; 16 and 1,004; 18 and 1,124; 21 and 1,278; 23 and 1,415.

Eighteen feed changes are available through selective sliding gears, controlled by two levers. The feeds range from 0.006 in. to 0.125 in. per revolution of the spindle, and include tap leads for 8-, 11½-, and 14-thread pipe taps. The tap leads are provided with the object of relieving the operator of exertion in starting the taps and to eliminate the possibility of thin threads. The compensating depth gage makes it possible to set the trip so that either the point of the drill or the body of the drill will advance a given distance into the piece being drilled. Speed and feed gears are of heat-treated steel.

Tapered roller bearings are used for all of the driving mechanism. They are sealed against the entrance of dirt and are automatically oiled. The upper bearing of the spindle is of tapered rollers and the lower is of cylindrical rollers. Both bearings are packed in grease that needs to be renewed once in three months under ordinary conditions. A ball thrust bearing is provided.

All shafts are multiple-splined, with integral keys. The spindle has six integral keys, with the object of adding strength and accuracy in driving, especially on such work as tapping with large pipe taps.

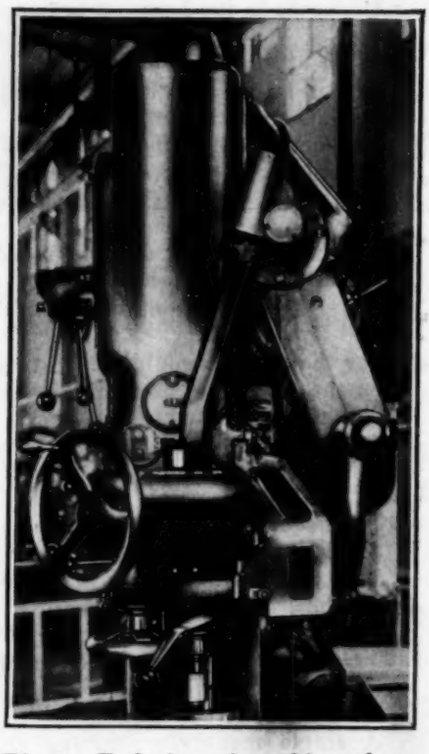


Fig. 3—End view of machine, showin square gibbing

Oiling is practically automatic. A built-in pump supplies forced lubrication to the head, the oil being forced through a Purolator filter. Central-station oiling, operating from the head, keeps the arm-bearing surfaces lubricated. The oil is led to the bearing surfaces from the reservoir by wicks and copper tubing. The gears and clutches in the arm-raising and lowering unit and the

Shop Equipment News

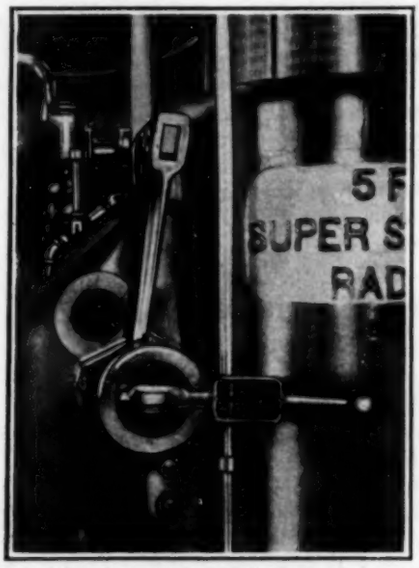


Fig. 4—"Mono" arm control

driving gears between the motor and the arm shaft run in oil. The outer bearing of the arm shaft is packed in grease.

Sampson alloy steel, having an ultimate tensile strength of more than 200,000 lb. per square inch, is used for the spindle, spindle sleeve, and feed-rack pinion. The feed rack is integral with the spindle sleeve.

An adjustable spring counterbalance, enclosed in the head, is provided to counterbalance the spindle in all positions. The spring is of the flat, coil type and its tension can be adjusted from outside the head, by turning a shaft connected to the inner end of the spring by means of worm and worm wheel. The action serves to "wind" or "unwind" the spring. The outer end of the spring is connected by a chain to the spindle sleeve, passing over a cam provided to keep the pull on the spindle constant. Between the cam and the sleeve the chain bears against a small swiveling safety-block, spring-opposed, and fastened to the spindle sleeve. If the chain should break, the spring will force the block into one of a number of slots on the chain guide bar (fixed, so far as vertical motion is concerned), thus preventing falling of the spindle. Lugs, cast on the cam and the cam housing, prevent unwinding of the spring in case the chain breaks.

Another safety device is provided to prevent falling of the arm if the elevating nut should fail. It consists of a second, and smaller nut, traveling on the elevating screw above the working nut. The safety nut carries no load, so that the only wear on the threads is that caused by turning idly on the screw. A heavy flange on the safety nut enters a recess in the arm casting, and in case of failure of the working nut the arm will drop through a distance of less than ¼ in. to rest on the flange of the safety nut. The raising and lowering mechanism has no connection with the safety nut, hence the arm cannot be elevated or lowered until the working nut is replaced.

The head is square-gibbed to the arm, as shown in Fig. 3. The arm is of triple-box section, the front and rear walls being tied together by longitudinal ribs. There are no openings in the rear wall.

Unlocking, raising, lowering, and locking the arm are accomplished by means of a single lever. With the lever in the position shown in Fig. 4, the arm is unlocked. Movement of the lever up or down through short controlled distances will elevate and lower the arm. To lock the arm, the lever is pulled out of the slot and revolved in a clockwise direction through about 330 deg. The movements are interlocked. In locking, the control lever turns a floating nut to push the locking levers apart. Each lever pushes against a pin in one side of the arm and pulls on a pin bearing against the other side of the arm. The resultant squeeze holds the arm to the column. Unlocking is just the reverse, and is a positive action. Greater leverage is provided for closing the upper end on account of the greater resistance at that point. Safety stops prevent movement beyond the upper and lower limits of travel.

The construction of the lower part of the column, to permit easy swinging of the arm, makes use of four hardened, steel rollers mounted on roller bearings, themselves mounted on pins of slight eccentricity to permit of accurate adjustment in assembly. The rollers bear on a hardened and ground steel ring on the trunk.

It will be seen that one of the principles of the design has been to provide for easy and speedy operation, as exemplified by provisions for the control of speed and feed changes, arm locking, and rapid traverse from the head, and for the control of elevating and lowering of the arm and column-clamping by means of a single lever.

SPECIFICATIONS

	5 Ft. Machine	6 Ft. Machine
Drills in plane of base to center of circle of	10 ft	12 ft.
Distance from center of column to face of column	11⅛ in.	13 in
Minimum distance, face of column to spindle	10⅞ in.	10½ in.
Minimum spindle radius	22 in.	23¼ in.
Horizontal traverse of head on arm	4 ft. 1⅛ in.	5 ft. 1⅞ in
Maximum spindle radius	5 ft. 11⅛ in.	7 ft. 1 in.
Minimum distance, spindle to base	14 in	16½ in.
Vertical traverse of spindle in head	18 in.	18 in.
Vertical traverse of arm on column	3 ft. 1 in.	3 ft. 7½ in.
Maximum distance, spindle to base	5 ft. 9 in.	6 ft. 6 in.
Extreme height of head above floor	11 ft. 5½ in.	12 ft. 3½ in.
Extreme height of column above floor	10 ft. 1 in.	11 ft. 1 in.
Height of base	9 in.	10 in.
Working surface of base	3 ft. 9 in. x 5 ft. 4 in.	4 ft. 2 in. x 6 ft. 5 in.
Height of plain table	20 in.	20 in.
Working surface of plain table	21 ft. x 28 in.	25 ft. x 33 in.
Height of universal table	23 in.	24 in.
Working surface of universal table	24 in. x 24 in.	28 in. x 28 in.
Morse taper in spindle	No. 5	No. 5
Horsepower of motor	15 to 20	15 to 20
R.p.m. of motor	1,200	1,200
Size of driving pulley	16 in. x 4¾ in.	16 in x 4¾ in.
Net weight	16,100 lb.	22,000 lb.

Pratt & Whitney D. L. Gages

The Pratt & Whitney Co. Division of the Niles-Bement-Pond Co., Hartford, Conn., has placed on the market a line of gages known as P. & W., D. L. process gages. The gages are made from a special alloy and when given the proper heat-treatment and lapping finish, are said to have phenominal wear-resisting properties.

Because of the peculiar heat-treatment given, the gages do not prove glass-hard when tested with a file. Paradoxial as it may seem, they do not wear as well when glass-hard as they do when given a heat-treatment that leaves them slightly soft.

Shop Equipment News

Pratt & Whitney Automatic Worm-Grinding Machine

The Pratt & Whitney Co. Division of the Niles-Bement-Pond Co., Hartford, Conn., has placed on the market the automatic worm-grinding machine shown in the illustrations.

The machine is automatic and will grind either single or multiple threads on one or both sides, as desired. It is quite simple in construction and is sturdily built. The bed supports a sliding table and a wheel slide that are at right angles to each other. All controls are on the front of the bed, and change gears are provided for the necessary work speeds.

The machine is motor-driven and requires a 5-hp. constant-speed motor for thread depths up to 0.400 in. For thread depth from 0.400 to $\frac{5}{8}$ in., a $7\frac{1}{2}$ hp. motor is required. The motor is mounted on a pad on the bed of the machine, and is belt-connected to the various movements. The table movement is started and stopped by means of a friction clutch.

The wheel head is so arranged that the wheel can be swung 30 deg. to the right and 45 deg. to the left to accommodate various thread angles. Graduations are provided for accurate setting. The drive to the wheel is by belt and through spiral bevel gears running in oil.

The wheel is fed to depth by means of a screw, operated by means of a handwheel on the front of the bed. A ratchet having 200 teeth is attached to the screw and is operated by dogs on the table. A movement of 0.00025 in. is given the wheel slide by each tooth in the ratchet.

The machine grinds in one direction only, the wheel being withdrawn from the work after each pass, returning to grinding depth when the work reaches the starting position. The table has a maximum travel of 7 in., and its movement is controlled by a cam, specially cut to suit the lead of worm being ground. A very simple device takes care of indexing for multiple threads.

A handwheel on the work head operates a differential gear, changing the relation between the lead of the work and the grinding wheel. This arrangement provides means for picking up the lead when setting work, and can also be used to give a longitudinal feed to the work when one side only of the thread is being ground. The truing device, carrying a diamond, can be swung into position when needed, but is out of the way when grinding.

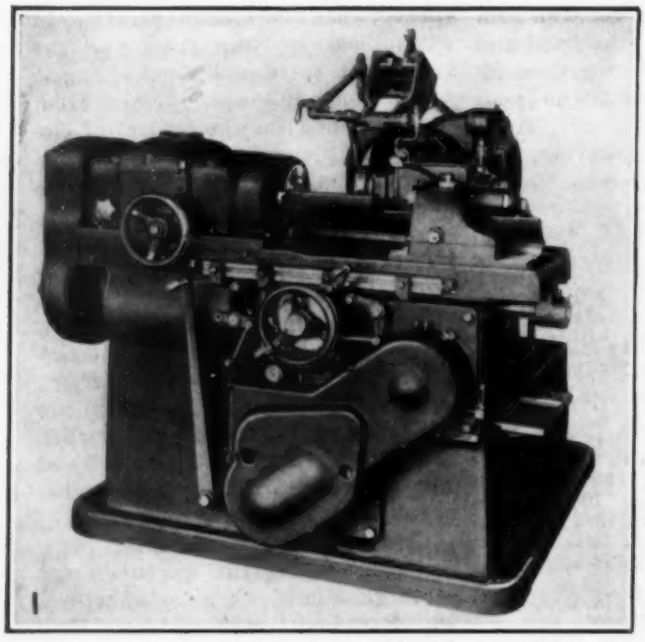
All moving parts of the machine are enclosed by metal guards. The regular equipment includes a water pump, tank and suitable piping for delivering a continuous stream of coolant to the grinding wheel and returning it to the tank.

Cincinnati Motor-Driven Speed Lathe

The Cincinnati Electrical Tool Co., Cincinnati, Ohio, has placed on the market the motor driven speed lathe shown in the accompanying illustration. The machine is designed for boring, reaming, countersinking, filing, polishing, and lapping small parts. It is particularly adapted for work on automotive parts.

The standard speed of the machine is 900 r.p.m., but it can be furnished with a motor giving speeds ranging from 90 to 3,400 r.p.m., according to the requirements of the purchaser.

A speed of 90 r.p.m. is recommended for such work as reaming piston pin holes, burring hinge rods, and fitting piston pins to connecting rods. A speed of 300 r.p.m. is recommend for finish reaming of babbitt bearings, while a speed of 900 r.p.m. is recommended for such operations as reaming babbitt from bolt holes, remov-



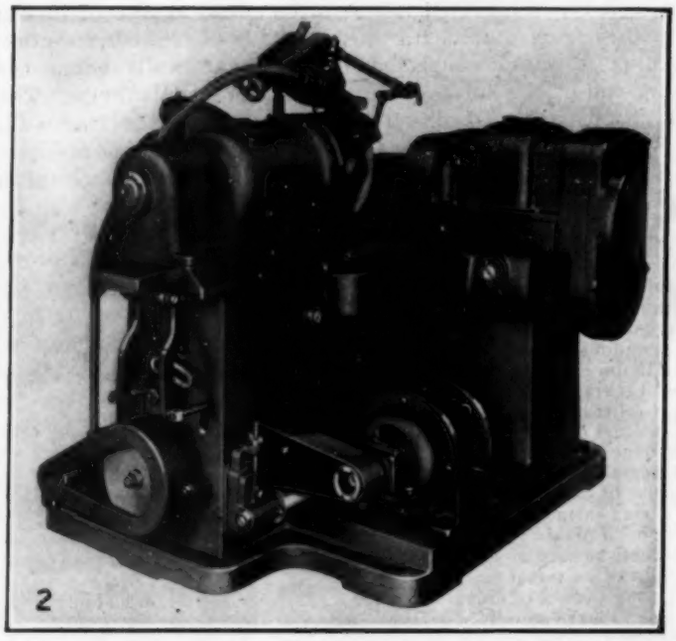


Fig. 1—Pratt & Whitney Automatic Worm-Grinding Machine. Fig. 2—Rear view of the machine

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Cincinnati Motor-Driven Speed Lathe

ing excess tin from connecting rods, and burring and chamfering bolt holes.

The motor is rated at ½ hp. and can be furnished for operation on either a.c. or d.c. circuits. The armature and all gear shafts are mounted upon radial ball bearings. A ball thrust bearing is also provided. A table having micrometer screw adjustment can be furnished, if desired. The machine can also be fitted with a multiple-spindle head. The machine is regularly equipped with a No. 2 Morse taper socket.

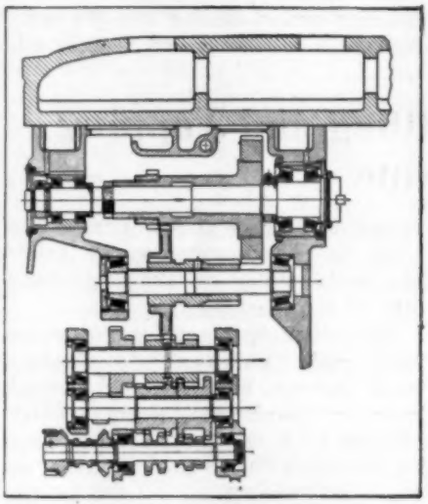
The weight of the unit is approximately 125 pounds.

Cincinnati No. 5 Milling Machine with Roller Bearing Spindle

The latest development in design by the Cincinnati Milling Machine Co., Cincinnati, Ohio, is to apply tapered roller bearings to the main spindle in addition to the other power shafts in the machine, as shown in the sectional view. The main feature in this application is the use of double bearings at each end of the spindle.

The bearings are so mounted on the spindle as to have the front pair take the thrust, while the rear bearings are free to move endwise sufficiently to compensate for any heat that may develop.

The details of applying these bearings to the spindle have been very carefully worked out with the result that the builders believe that the new bearings will be more satisfactory in every way than the plain bearing formerly used. It is believed that these bearings can be run with almost no allowance for oil film, making it possible to secure practically a metal to metal fit and thereby eliminate much of the tendency to chatter. That the machine will operate with less bearing friction than before is indicated by the claim that an average of about 20 per cent more power is delivered to the cutter with the same motor when roller bearings are used.



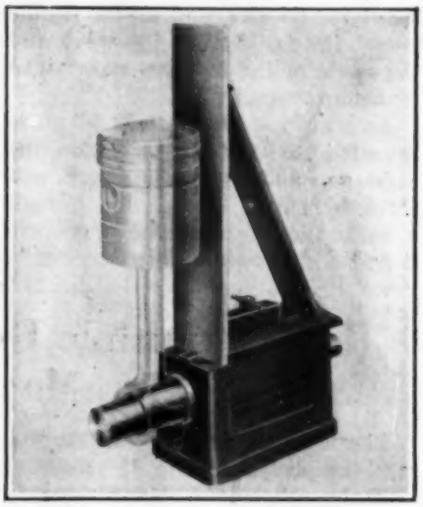
Cincinnati No. 5 Milling Machine with Roller Bearing Spindle

"Squarod" Piston-Aligning Fixture

To facilitate the alignment and straightening of piston and connecting rods, the Geo. H. Blettner Co., 1841 West Jackson Blvd., Chicago, Ill., has placed on the market the "Squarod" piston aligning fixture.

The fixture has a movable square resting on a rugged base that grips arbors of various diameters to hold the different connecting rod assemblies.

As can be seen in the accompanying illustration, the square can be slid out of the way or brought into contact with the work for guidance or proofing purposes while the rods are held and being corrected for alignment.



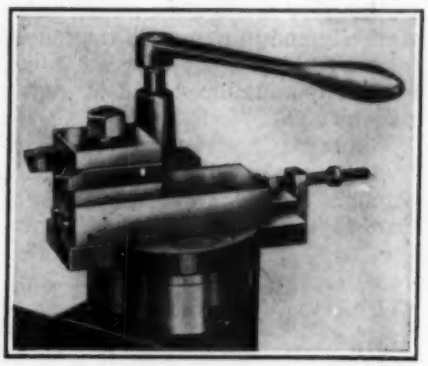
"Squarod" Piston Aligning Fixture

The fixture is of rugged, simple construction. The fastening lugs are cast inside the base to prevent dirt from catching in the corners. It is made from heat-treated castings machined and ground. It is finished in black backed enamel. The bench space required is 5x8 in. Its height is 20 in. The weight of the device is about 70 pounds.

Porter-Cable Angular Facing Attachment

The Porter-Cable Machine Co., Syracuse, N. Y. has placed on the market the angular facing attachment for its lathes shown in the illustration.

The attachment is mounted on the tailstock ways and can be moved to any position along the bed. The swivel feature allows the tool to be presented to the work at any angle, and to be fed in by hand at the desired speed. The depth of cut is



Porter-Cable Angular Facing Attachment

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regulated by means of an adjustable stop. Its position on the ways and the angle of the tool are maintained by clamp screws.

An open-type toolholder is mounted in dovetailed ways on the carriage, and is moved back and forth by means of a lever through a rack and pinion. The ways are mounted on a swivel plate that can be rotated in any direction and clamped in position.

In addition to its adaptability for such work as facing blanks for bevel gears, the attachment is useful for chamfering or necking work, either before or after the turning operation. The supporting member is a strongly-ribbed casting and the moving parts are machined from steel.

Hoefer Multiple Drilling and Tapping Machine

The multiple drilling and tapping machine shown in Fig. 1 has been built by the Hoefer Manufacturing Co., Freeport, Ill., for the drilling of six holes located in a lock spindle of the ordinary door lock, as illustrated in Fig. 2. It can be seen from Fig. 2 that the small holes have their centers only ¼ in. apart.

The drilling unit as a whole consists of a special type high-speed, all ball-bearing sensitive drilling machine with an automatic feed mechanism, a twelve-spindle adjustable auxiliary head and an automatically indexing jig.

The machine has the general features usually found on sensitive drills, including the base, table, elevating device, a 12-spindle head, belt tightener, countershaft, and in addition it has two supports under the idler-pulley carrier, to give greater rigidity to counteract the greater pressure of the 12 drills in the auxiliary head. A belt guard has been placed around the front pulley as a protection in case the belt should break. The quill support or bearing is cast solid with the head, instead of sliding as in the usual type. This provides a more compact mounting for the feed mechanism which, automatically and in time with the indexing of the jig, feeds downward and returns the auxiliary head in a continuous cycle.

The feed mechanism is driven from the main pulley on the spindle through the hub, extending downward through two annular ball bearings, and it extends sufficiently beyond to carry a hardened-steel worm which is in mesh with a bronze worm gear. On this shaft, on which is located the worm gear, is a hardened clutch by which the operator can start or stop the continuous cycles of feeding at any time. The lever is placed conveniently below the main pulley on the right-hand side of the machine.

The shaft that carries the worm gear and clutch extends straight back through bearings, and carries another hardened worm which meshes with the bronze worm gear on the upper end of the cam drum on the vertical shaft, to the left of the main spindle. All worms and worm gears are entirely inclosed in a housing to permit continuous lubrication. The cam is of the ordinary built-up section type and is made with

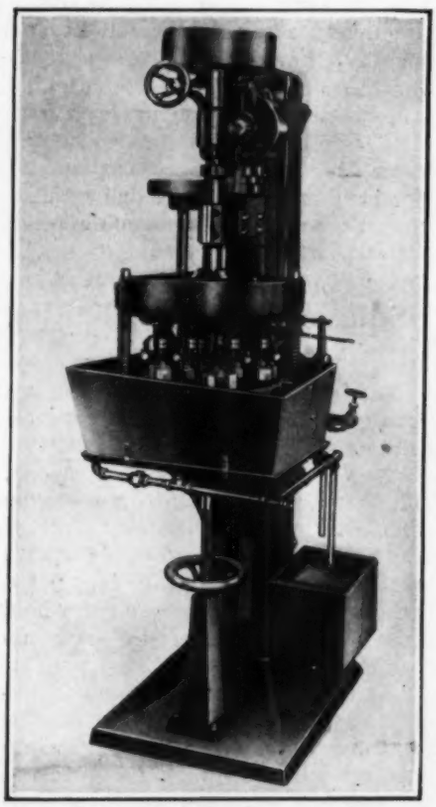

Fig. 1—Hoefer Multiple Drilling and Tapping Machine

rapid-approach, feed, quick-return and dwell positions. During the time these different segments are in operation, the various functions of drilling, indexing and so forth are being performed in synchronism. The cycle of the cam in the machine illustrated is 12 sec., so that ample time is allowed for various operations, but still a high rate of production maintained. The ratio between the main pulley and the cam is 240 to 1.

The auxiliary head is a 12-spindle head in which the spindles are grouped, four in each group. The centers are so close that only two holes are drilled in two lock spindles in each of the three drilling positions, but six holes are drilled in each

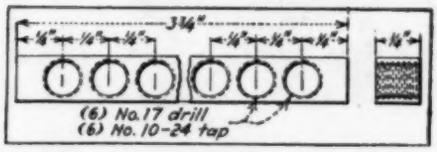

Fig. 2—Drawing of lock spindles with six holes

of two spindles at each indexing. The fourth position is used for loading. The head is made adjustable to accommodate different lengths of lock spindles, thus permitting one machine to take care of a variety of work. In order to maintain the alignment of the head and the jig, the two units are tied together by means of heavy guide rods on which springs are placed to act as a cushion and counterbalance for the head.

The automatically indexing jig consists of a hollow base in which is located the gears and the Geneva movement for the indexing, a cover for the indexing unit and a rotating table. Underneath the table there are carried on the baseplate, four upright supports which are scraped and form a bearing for the thrust of the table. The indexing movement consists of the train of gears which is on the upper end of the vertical shaft, rising from the left-hand side of the table, and which connects to the cam drum from which it secures its timing.

On the lower end of this shaft is another train of gears driving a Geneva movement. All the gears and the Geneva movement are fully encased. With this automatic indexing timed to the best advantage

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when speed and feed of drills are considered, rapid production is assured. The indexing table carries four fixtures of two each, so that when the table is full, eight lock spindles are provided for. These fixtures are of steel, hardened, and have a fixed end so that all holes are properly located from one end. The center lines of the two adjacent lock spindles in one fixture are 1¾ in. apart, so as to permit the use of ample gear centers in the head. Of the four fixtures, one is always in the loading position. When in this position, a cam beneath the table is in contact with the clamping mechanism for the lock spindles, so that in no way is the operator concerned with the locking or unlocking of his pieces in the jig. As soon as the table begins its motion to the next station, the clamping bars for the lock spindles ride off the cam, and by means of springs hold the spindles firmly in the jig while completing the cycle, during which the twelve holes are drilled complete on two spindles.

A guide-bushing plate having guide bushings for each drill is carried on the head. There are also provided V-blocks which raise and lower with the head, and which assure the proper location of the lock spindles so that all holes are drilled in a straight line. Lubrication is provided by means of a large geared pump delivering oil directly to the drills. The overflow is returned to a tank which is provided with a screen and settling basin.

The speed of the machine is 1,200 r.p.m., with an increase in the head in order to run the drills at 2,000 r.p.m. With 0.004 in. feed, the production is at the rate of 600 pieces per hour. Only one operator is required.

The tapping machine is identical with the drilling machine, except that it has in addition the tap reversing mechanism within the head, and a cam of slightly different profile. The cam is such that the taps are started with the proper lead, but slow down somewhat to allow the taps to float in advance of the head. This float is accomplished by built-in floating spindles and tap holders, which not only float vertically, but have a limited side float. The reversing trip is arranged to take place the instant the head reaches the bottom of the cam profile, which is such that the head withdraws in advance of the lead, utilizing the float in the spindles for compensation.

Rivett "Junior" Bench Lathe

The Rivett Lathe & Grinder Corporation, Brighton District, Boston, Mass., has brought out the bench lathe shown in Fig. 1, in which it is claimed that the non-essential details have been eliminated without sacrificing accuracy or range of usefulness.

The bed of this lathe, including the legs, is a single casting, which is machined only upon the upper surface and along two ribs beneath to provide a bearing for the binders of the slide-rest and footstock. The spindle of the headstock is of tool steel, the front end being hardened and ground. The bearings are split sleeves of cast iron, tapered on the outside so that adjustment may be made to compensate for wear.

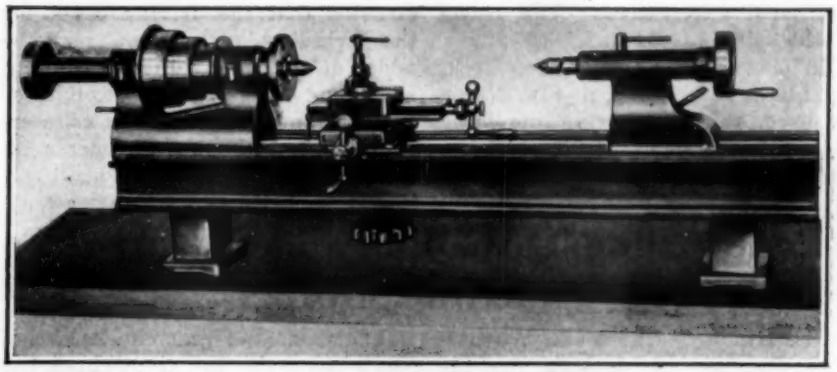

Fig. 1—Rivett "Junior" Bench Lathe

Instead of the usual threaded nose, the spindle has an enlarged shoulder at the front end with a taper to fit a tapered hole in the drive plate. The latter is thus held by friction upon the taper, and is further secured by two cone-pointed setscrews. The large tapered bearing surfaces of the spindle and plate may be cleaned easily so that a true-running plate is assured.

The construction permits the use of the 1-in. hole in the spindle at all times. It also allows the lathe to be run backward without danger of loosening the plate. The front end of the spindle hole is ground to take the regular No. 7 Rivett spring collet.

The pulley has three steps, and takes a 1¼-in. belt. The flange at the large end of the cone is drilled with 60 holes in order to provide a means of indexing work held in the spindle. These holes are engaged by a sliding pin in the pedestal of the rear bearing.

The compound slide may be set at any desired angle. Its base is graduated to 45 deg. on both sides of the zero line to facilitate setting. Both screws are provided with micrometer dials. A special rest in the metric system of measurement is furnished when desired.

The footstock is of the offset type to provide ample clearance for the

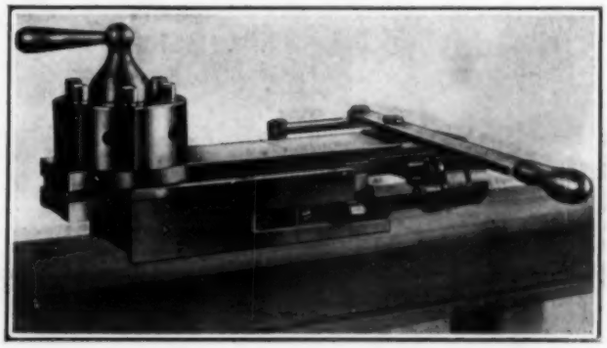

Fig. 2—Turret attachment for bench lathe

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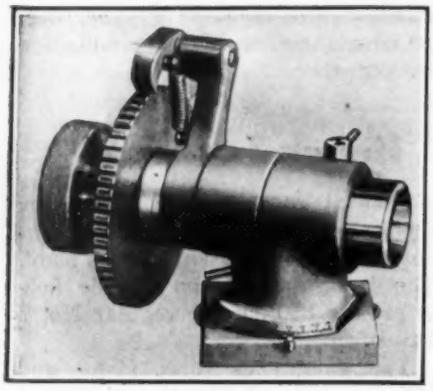


Fig. 3—Indexing attachment for milling

handle of the compound screw when the rest is set to wide angles. The tail spindle is locked in the barrel by means of a friction bushing actuated by the binder screw, instead of the usual split barrel. The travel of the spindle is 3⅜ inch.

In place of the regular footstock, the turret slide shown in Fig. 2 may be used, thus converting the lathe into a small hand screw machine. The attachment is furnished in two styles; one to be indexed by hand and the other provided with an automatic indexing mechanism. A threading attachment is also provided for the machine.

A milling attachment is provided, by which the operations of profiling, flat milling or keyseating may be performed upon work held in the collets, in a vise, or strapped to an angle plate that is a part of the device. An index milling head may be furnished as a part of this attachment when desired.

The lathe swings 8 in. over the bed, and 1⅞ in. over the compound slide. It will take a piece 17 in. long when the footstock is flush with the end of the bed, which capacity may be increased 3 in. by allowing the footstock to overhang. The regular equipment includes a two-speed reversible countershaft so constructed that the driving drum for the grinding attachment may be added at any time without installing additional hangers. The weight of the machine, including the countershaft, but without attachments, is 200 pounds.

Landis Pipe-Threading and Cutting-Off Machine, 4-In.

The Landis Machine Co., Waynesboro, Pa., has added to its line the 4-in. pipe-threading and cutting-off machine shown in the illustrations. The machine has a gear box and a single pulley drive, but can easily be converted to motor drive. The reversing mechanism is contained in the gear box and is operated by a lever convenient to the operator.

The front and rear chucks are of the 3-jaw type. The front chuck has universal adjustment and is lever-operated, thereby permitting work to be put in and taken out without stopping the machine. The rear chuck has independent adjustment.

The spindle is lubricated by flat-link chains running in oil reservoirs. The carriage supports the cross-rail, on which are mounted the dieheads, the centering jaws, the cutting-off tools, and the reaming tool. Two cutting-off tools are employed and are diametrically opposed in holders having a universal movement to and from the center. The holders can be adjusted horizontally for centering the tools. The reaming device is attached to the slide carrying the cutting-off tools and is operated by a lever.

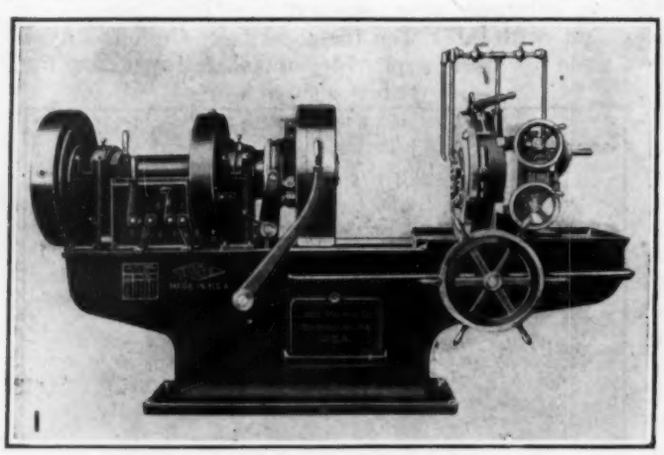
All operating levers are on the front of the machine and are conveniently placed. The circulating system for the cutting solution includes a rotary pump, a by-pass, and control valves at the die head and the cutting-off tools.

The range of the machine is from 1 to 4 in. and is covered by two die heads, a 2-in. head for from 1 to 2 in., and a 4-in. head from 2½ to 4 in. The die heads float horizontally on the cross-rail, and are equipped with Landis chasers. The machine has eight speeds. The carriage travel is 24 in. The floor space required is 53¼ x 102⅛ in. The net weight is 5,700 lb. when belt-driven, and 6,300 lb. when motor-driven.

Federal Individual Motor Drive for Presses

The individual motor drive shown in the illustration has been adopted by the Federal Press Co., Elkhart, Ind., and can be furnished for the complete line of open back, inclinable presses described on page 539, Vol. 64, of the *American Machinist*.

The motor bracket can easily be attached to the back of the uprights, and can be supplied to take any elec-



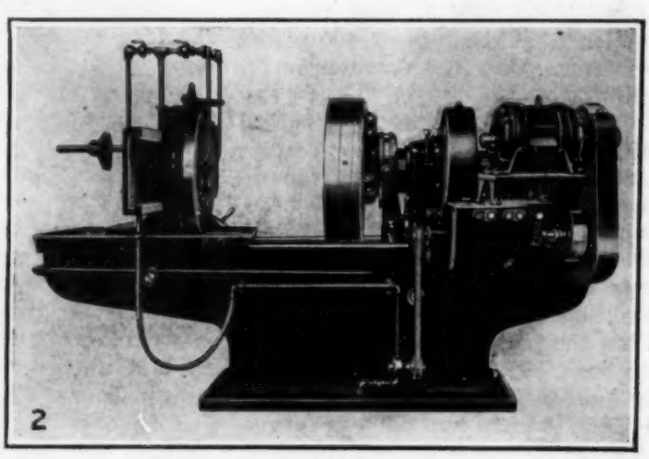


Fig. 1—Landis Pipe-Threading and Cutting-Off Machine. Fig. 2—Rear view of the machine

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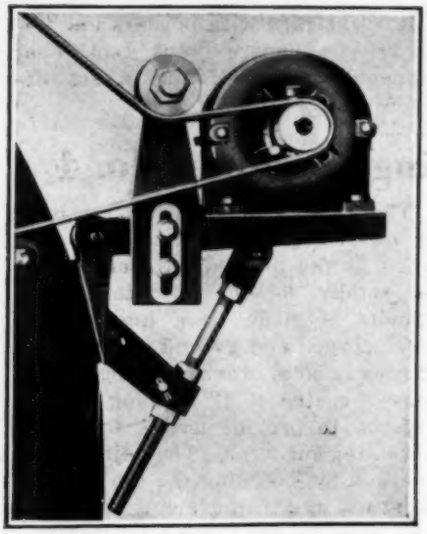
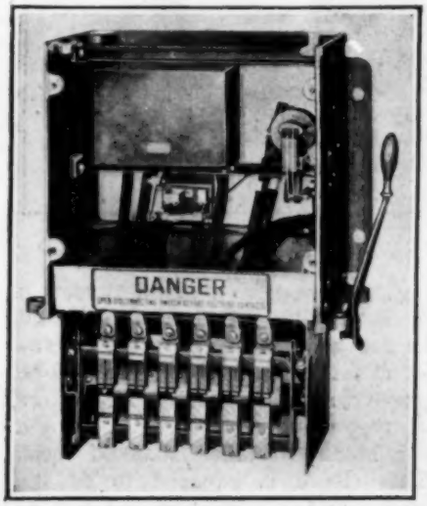


Federal Individual Motor Drive for Presses

tric motor of standard make. The drive from the motor to the flywheel is through a leather belt. Since the bracket is attached to the part of the press that is adjusted for position, the length of the belt remains constant, whether the press is operated in the usual upright position or in any of the inclined positions possible. The motor bracket can be adjusted so that it will be level when the press is in an inclined position.

General Electric Mill-Type Compensator, No. 2

To meet the demand for a compensator which will cover ratings above 30 hp. on 220-volt circuits, and 60 hp. and up on 440 and 550-volt circuits, the General Electric Co., Schenectady, N. Y., has introduced a new design designated as size No. 2. Two-part construction is employed in order to meet a wide variety of installation requirements.



General Electric Mill-Type Compensator, No. 2

One unit of the compensator consists of an oil-immersed, double-throw switch with temperature overload relay, push button station and undervoltage release. The other unit consists of an auto-transformer. Each unit is provided with a conduit box.

The control box is so arranged that the oil box may be lowered to allow examination of the switch parts and renewal of fingers and wedges. This unit can be mounted on the wall or attached to a pipe support.

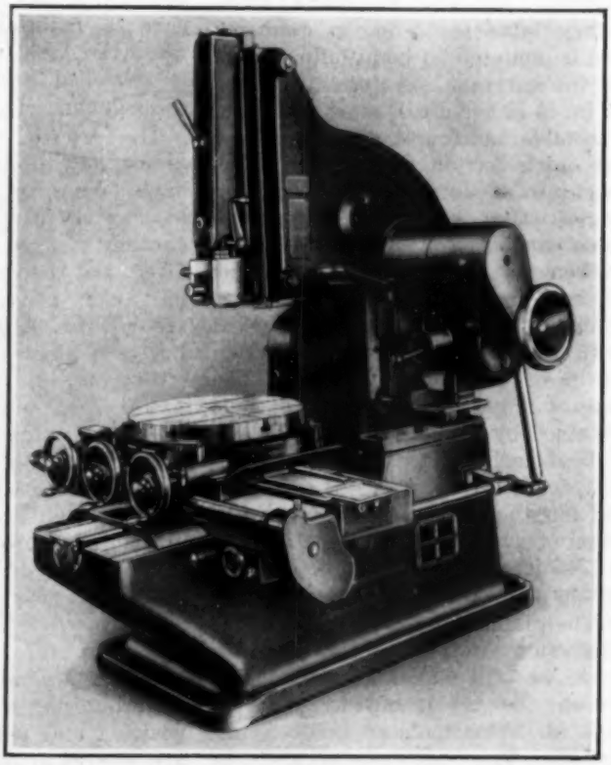
The auto transformer is inclosed in a cast-iron box having a removable cover to allow changing tap connections when desired. The conduit box mounted on the top of this case provides ample room for making connections. The front of the conduit box is removable, the entire interior thus being accessible in order that joints may be tightened and properly taped.

Pratt & Whitney Vertical Shaper Model B, 12-In.

The Pratt & Whitney Co., Division of the Niles-Bement-Pond Co., Hartford, Conn., has brought out the 12-in. vertical shaper shown in the illustration. Operating convenience and the range of speeds and feeds are the outstanding features claimed for the machine. All operating controls are within easy reach of the operator. The machine can be furnished with either a built-in motor drive or with a constant-speed belt drive. In either case the floor space is the same. When arranged for motor drive, a 5-hp. constant-speed motor is mounted inside the bed. Power is controlled by means of a lever having three positions: neutral, working and brake. A safety interlock prevents changing the speed gears when they are in motion.

Power is delivered to a gear box on the column. The gears are of alloy steel and are of Maag form. Four speeds and a neutral position are provided. The control is effected by an H-type shift lever. The gear box is inclosed and the splash system of lubrication is used. Power from the gear box to the ram is delivered through a large slotted eccentric and follower block, which produce the slow work stroke and the quick return. The ram is counterbalanced, and the entire mechanism is inclosed to insure cleanliness and safety.

The ram slide is hinged at the top and has a screw adjustment at the bottom, so that it can be set to any desired angle up to 5 deg. and locked



Pratt & Whitney Vertical Shaper, Model B, 12-In.

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in position. A scale is provided for making this setting. A handwheel attached to the gear box permits the ram to be moved through its entire travel by hand, for positioning at the start of a cut. The stroke of the ram can be varied from 0 to 12 in. by a locknut adjustment on the end of the feed cam. The speeds obtainable are 22, 37, 56 and 90 strokes per minute.

The toolpost binder screw has been eliminated, the tool, being held by drawing the toolpost against it from the rear. This feature permits the toolpost to pass over the work without interference. The toolhead can be rotated 360 deg. and can be clamped in any position.

Power feed for the entire machine is obtained from a feed cam on the upper right-hand side of the column. The lever for varying the feed is equipped with a safety device that prevents injury to the mechanism if the tool or the work should become jammed through careless operation. The feed gear box, located at the right of the bed directly below the table, provides forward, neutral, and reverse feeds, and is controlled by means of a knob on the bed.

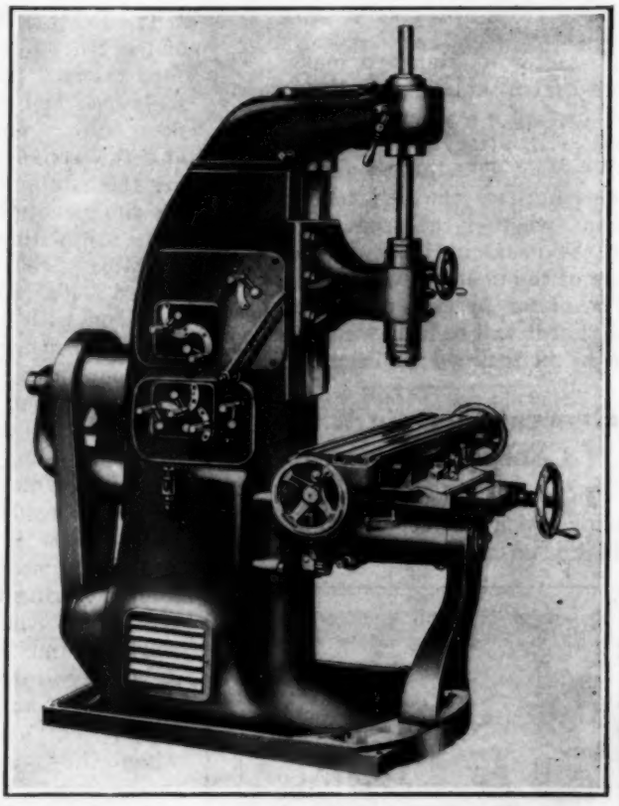
The carriage is wide and is mounted on dovetail ways. The rotary table is 24 in. in diameter and is mounted on longitudinal ways on the carriage. A total travel of 25 in. in either direction is available. The table has four indexing notches for quick setting of surfaces to be machined at right angles. For other angles the graduations on the table can be used. Handwheels and micrometer dials are provided for all adjustments of the carriage and table. All handwheels are marked with arrows to show the direction of the feeds they control. The change from hand to power feed is obtained by means of a knob on the hub of each handwheel. The available feeds are from 0.0021 to 0.0833 in. for the transverse and longitudinal travels, and from 0.043 to 0.1745 in. on a 10-in. radius for the rotary motion of the table.

The distance from the table to the underside of the ram bearing is 14-in. and the maximum distance between the table and the ram is 24½ in. The toolpost takes a tool ⅞x1⅛ in. The floor space occupied by the machine with either belt or motor drive is 60x86 in., and the overall height is 101 in. The weight is about 7,500 pounds.

The regular equipment includes two workstraps with bolsters and T-bolts, one square-joint tool, one diamond-point tool, and a set of wrenches.

Knight Vertical Milling Machine, No. 4

The W. B. Knight Machinery Co., 3920 West Pine St., St. Louis, Mo., has placed on the market the No. 4 vertical milling machine shown in the accompanying illustration. The column and the base of the machine are cast integral and are heavily ribbed to give large, strong and rigid bearing surfaces for the other parts. The column is designed to allow the entire table unit to swivel around it to increase the range of the machine. The projection arm on which the knee, saddle, and table are mounted, is of heavy construction and has a large bearing on the column. Rigid support is provided for the outer end of this arm. The support has a wide bearing directly on a machined arc on the basis of the miller, so that this support is maintained when the table unit is swivelled around the column.



Knight Vertical Milling Machine, No. 4

The knee, the saddle, and the table have long, wide bearing surfaces accurately scraped and fitted, and the entire unit can be tilted around the projecting arm 45 deg. to either side of horizontal. A worm screw is provided for tilting the table, and the degree to which it is to be tilted is indicated by a graduated segment on the projecting arm. When the table is in a horizontal position, a large taper pin is placed through the knee and the projecting arm to insure rigidity and accurate alignment. The unit is designed so that work can be placed in position and machined where there are several angles or positions without changing the set-up of the piece.

The spindle head may be raised or lowered by means of a screw, and when at the desired position it can be solidly locked in place. The spindle is made from high-carbon steel, forged and ground to size, and it runs in solid bronze bearings. The lower bearing is 12 in. long and is tapered to provide means for compensating for wear. The adjustment is made by loosening the top adjustment nut and then drawing the bearing down on the spindle by tightening the lower nut. End thrust is taken up by hardened steel and bronze washers. The nose of the spindle is threaded and recessed to provide a positive drive for cutters or the adapter sleeve that is used for holding smaller shanked tools. This sleeve is squared to fit the recess and has a hardened nut to draw it securely into the spindle. By reversing this nut, the sleeve is

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easily removed. Cutters are held securely in the adapter sleeve by means of a short draw-bar.

The machine has a constant-speed drive direct through a Johnson friction clutch built into the machine. It can be arranged for either belt or motor drive with a motor in the base. The motor is connected with the clutch by means of a silent chain. The motor compartment in the base is well ventilated and is protected from dirt and oil. All shafts, gears, and clutches in the machine are made from heat-treated alloy steel. Other parts subjected to stress and hard wear, such as shifter yokes and racks, are made from cast steel.

Both the feed and the speed changes are accomplished through a sliding-gear transmission, which is designed so that all gears not in use are locked in neutral. The spindle speed gears are assembled in one unit, mounted on the left side of the machine, and the feed gears in another unit directly underneath. The spindle and the feed-change levers, the starting lever, the brake, the reversing lever, and the table-and spindle-feed controls are all in convenient reach of the operator. Power feed on the spindle is reversible and is equipped with adjustable stops as well as positive ones to prevent over-travel. The table can be locked when boring operations are performed. A positive forced-feed lubricating system floods all gears and bearings.

The illustration shows the use of Knight precision locators. These locators consist of three hardened and ground steel posts specially fitted to the individual machine when desired. They make the machine well adapted to jig-boring and similar work requiring the accurate spacing and machining of holes.

Foote-Burt Mud-Ring and Flue-Sheet Drilling Machine, No. 3

The No. 3 mud-ring and flue-sheet drilling machine, illustrated in Fig. 1, has been designed by the Foote-Burt Co., Cleveland, Ohio. The machine is regularly equipped with four of this company's No.-30 head. It was designed to drill the rivet holes around the fire-box mud rings and the flue holes in boiler flue sheets for use in the larger types of modern locomotives. In order to make possible the drilling of large flue sheets in one setting, the table has a long travel and the spindles can be adjusted back and forth as well as in and out.

The spindles overhang the finished edge of the base so that mud rings can be bolted to this finished edge by means of three "T" slots running horizontally. The table is supported by five knees: the extreme outside knees are fixed, but the three middle knees are adjustable back and forth in case they interfere with the clamping of mud rings. When the machine is used to drill flue sheets, all knees are securely doweled in position to support the table.

The machine is so arranged that a pit can be placed in the floor flush with the front finished edge of the base to permit the mud rings to project down into the pit while the rivet holes are being drilled.

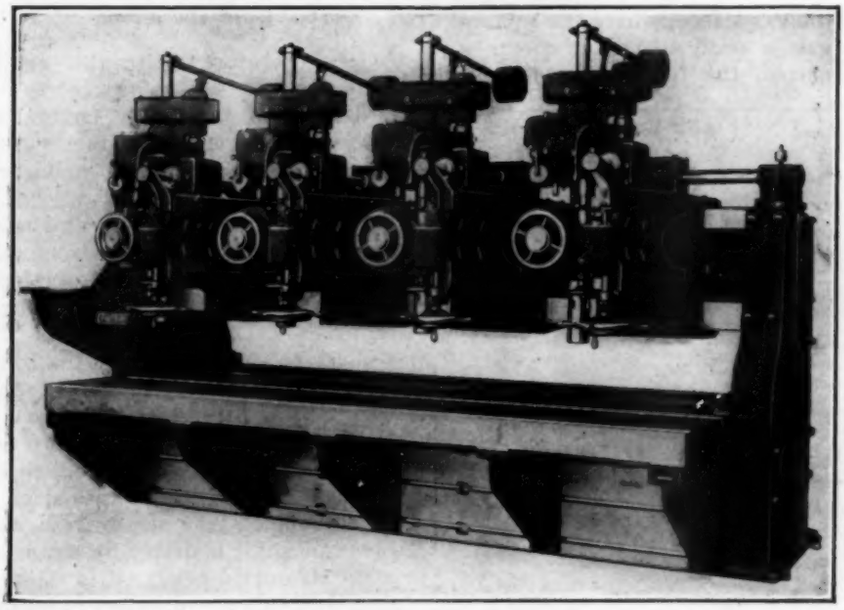

Fig. 1—Foote-Burt Mud-Ring and Flue-Sheet Drilling Machine, No. 3

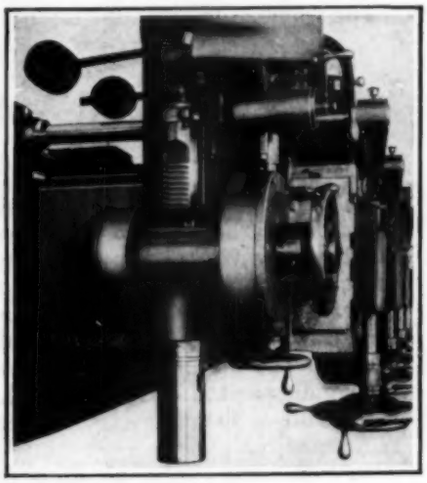

Fig. 2—Arrangement of the spindle controls

The machine can be arranged for either belt or motor drive. The power is transmitted through a heavy horizontal shaft where it is distributed to each head by means of bevel gears. The driven bevel gear is mounted on a vertical shaft, from which the spindle is driven directly by means of spur gears. The shafts are mounted upon bronze bearings. The gears are made of high-grade steel.

The spindles are made of high-carbon steel and have long bronze bearings in the spindle sleeve. The spindle sleeve is also made of steel, and the double rack is cut solid.

Each head is equipped with three feed changes independent of each other. The speed changes are accomplished by means of a cone pulley and back gears, when the machine is arranged for belt drive, or by a variable speed motor when arranged for motor drive. In the latter case

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the speed for each head cannot be changed independently.

Each head is adjustable along the rail, the minimum center distance being 24 in. while the maximum distance between the two outside spindles is 123 in. Each spindle also has an in and out adjustment of 18 in. In Fig. 2 the hand wheels for controlling the adjustments of the heads are seen. They are located at the front of the machine within easy reach of the operator. Each head has a drilling capacity of 2½ inches in steel or 7 inches using a trepanning tool.

The frame of the machine has been designed for rigidity. The crossrail carrying the head is a box type and is placed in large slots in each of the uprights. It is bolted in three directions. Each head slide is wrapped completely around this box-type crossrail and is securely gibbed to obtain the maximum amount of bearing. The uprights carrying the crossrail are bolted to the base in an L-shaped pad.

The table has a working surface of 75x144 in. and has an in and out adjustment of 60 in. When drilling mud rings it is placed at the extreme rear position. The unit weighs about 40,000 pounds.

Wickes Semi-Automatic Crankshaft Lathe, 20-In.

The 20-in. semi-automatic crankshaft lathe shown in Fig. 1 was developed by Wickes Brothers, Saginaw, Mich., for machining the center bearing, the flange end, and the front end of automotive crankshafts. The machine was designed for rigidity and is capable of taking heavy cuts without having its accuracy impaired.

In Fig. 1 the tooling set-up is for the straddle facing of the flange, turning the outside diameter of the flange and forming the oil groove and oil throw ring. In Fig. 2 the tooling set-up is for machining the rear bearing, the flange, the oil groove and the oil throw ring, while in Fig. 3 the tooling is for cheeking, turning, filleting and shouldering the front bearing and the front end of the crank.

The machine is arranged with silent chain drive from a 7½-hp. constant-speed motor rotating at 1,200 r.p.m. The headstock is equipped throughout with heat-treated, chrome-nickel steel gears which provide twelve spindle speeds. Eight feeds are available from the feed box. The machine is arranged for both power cross feed and power longitudinal feed with automatic longitudinal and cross feed stops.

The machine is also provided with automatic cross feed changes. The cycle is as follows: When starting the cross feed, where the removal of only a small amount of metal is required, the feed is rapid. As the tool bits move down toward the finished diameter of the crank and the cut becomes heavier, the feed is automatically reduced in order to prevent overload of the tool bits or the machine itself.

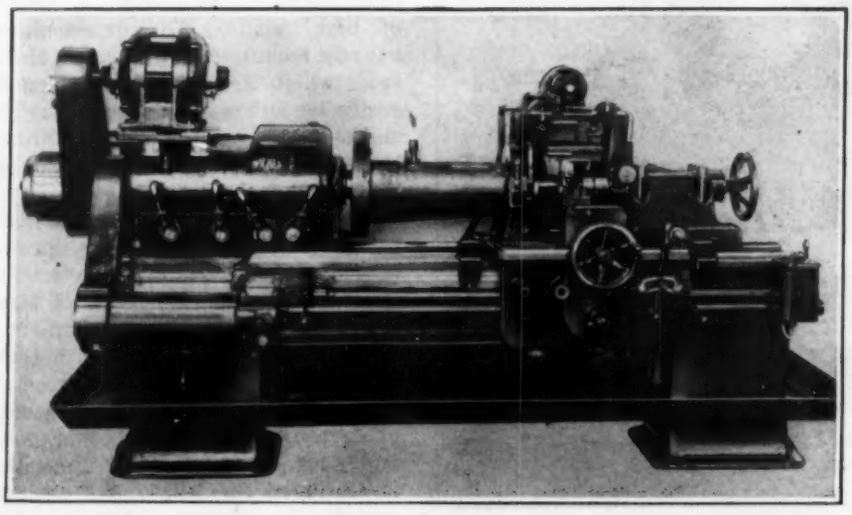

Fig. 1—Wickes Semi-Automatic Crankshaft Lathe, 20-in.

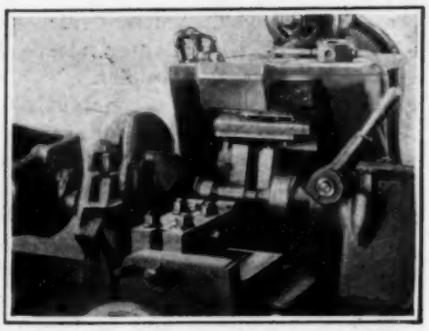

Fig. 2—Tooling set-up for machining the rear bearing

In addition to the automatic power feed, the machine is equipped with a patented electric rapid cross traverse to the tool bit. The controller for the rapid traverse motor is mounted near the apron convenient to the operator. With this equipment the tools can be brought to the cutting position rapidly, and after the completion of the cut they can be quickly reversed to the unloading position.

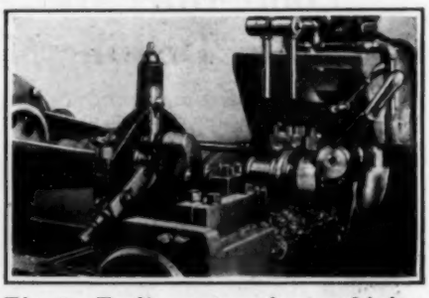

Fig. 3—Tooling set-up for machining the front bearing and the front end crank

With the tooling set-up as shown in Figs. 1 and 2, both the front and rear tool bits are fed straight in toward the center without longitudinal movement, while with the tool set-up shown in Fig. 3 the front tools are fed longitudinally, and simultaneously the rear tools are fed in toward the center. In each case the crankshaft is supported on one of the center bearings by means of a steel trunnion-type steady rest, and the crankshaft is driven by means of a suitable drive head. It is claimed that with this arrangement of steady rest and drive head, deflection

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of the crankshaft is prevented even under heaviest cuts. The rear tools are carried on an inverted slide. With this construction, it is said that the chips are carried away without interference with the cutting tools or without damaging the cross slide.

The tailstock is of extra heavy construction and is provided with an anti-friction live center. Other parts of the machine are equally rigid. The machine is provided with a suitable coolant pump and tubing together with a chip pan.

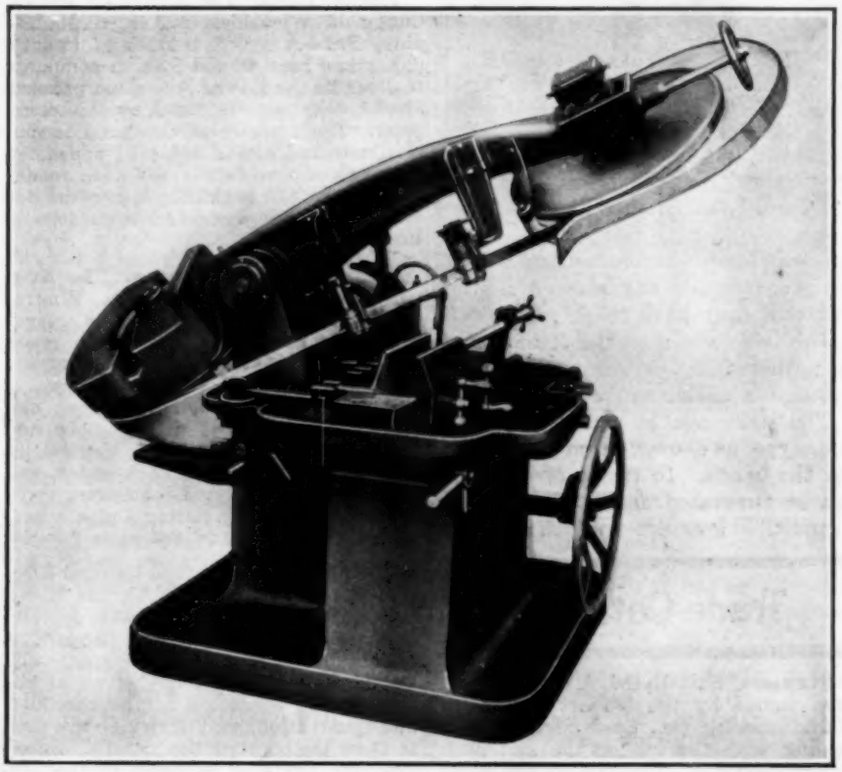
Avey "Milband" Cutting-Off Machine 6-Inch

The "Milband" cutting-off machine shown in the accompanying illustration has been placed on the market by the Avey Drilling Machine Co., Cincinnati, Ohio, for cutting off bar stock up to 6½ in. in diameter. As can be seen in the illustration the machine is of the band-saw type for continuous cutting.

The work is clamped in a double vise at both sides of the cut, and a rigid, adjustable stock-stop is furnished for gaging the length of stock to be cut off. The machine is equipped with the "Aveymatic" feed mechanism, which is built into the bed of the machine. Advancing the saw blade to the work by means of a large pilot wheel, automatically engages the feed. At the end of the cut, the feed is automatically disengaged, and the saw returns to its highest position. The guide rolls attached to arms on both sides of the cut are hardened and ground tool steel, ball bearing mounted, with easy adjustment to maintain true guiding action on the saw. The tension of the saw blade can be adjusted by means of a handwheel.

A geared pump is driven from the main drive shaft and gives a full flow of coolant to the blade. All lubricant is strained before draining to the reservoir in the base. Aluminum self-draining band saw guards inclosing the saw blade, give protection to the operator. Three blade speeds are available from one lever, operating sliding gears. The gear shafts are mounted on radial type ball bearings. The flanged band wheels are ball-bearing mounted and the idle wheel has self-aligning bearings with adjustment to facilitate tracking the band.

The regular machine has tight and loose pulleys with start and stop lever on front of machine convenient to the operator. The machine can be arranged for a belted motor drive attachment. Two hp., 1,200 r.p.m. for either a.c. or d.c. current is required. Motor bracket is adjustable for belt tension. The capacity of the machine is for material 6½ x 6½ in. in size. The standard saw speeds in ft. per min. are 176, 135 and 95. The number of selective feeds is 6, and with extra change gears 18. The floor space required by the machine is 53 x 87 in. The height of the machine from floor to vise is 27½ in. Its approximate net weight is 2,200 pounds.



Avey "Milband" Cutting-Off Machine, 6-Inch

Barnes Production Drilling Machine, No. 340, 20-In.

The W. F. and John Barnes Co., Rockford, Ill., is marketing the No. 340, 20-in. production drilling machine illustrated. The unit is a single-purpose machine and is rated to pull a 1½-in. high-speed drill to its full capacity in steel. It is built in either single-spindle or gang-drill types.

The design of drill follows closely previous models made by this company. The chief departure is in the form of a built-in motor drive. The motor is carried in a housing on the rear of the head and is connected to the driving shaft by means of a fibre pinion. Individual drive from separate motors is used for the gang drills, which are furnished with two to six spindles. In each case the motors are rated at 5 hp. at 1,200 revolutions per minute.

Spindle speeds ranging from 104 to 418 r.p.m. are available by means of pick-off gears. Twenty-four feeds, ranging from 0.005 to 0.115 in. per rev., can also be obtained by means of pick-off gears. Both the main and the intermediate drive shafts are carried on Timken tapered roller bearings running in a bath of oil. The spindle drive is through multiple-splined steel shafts

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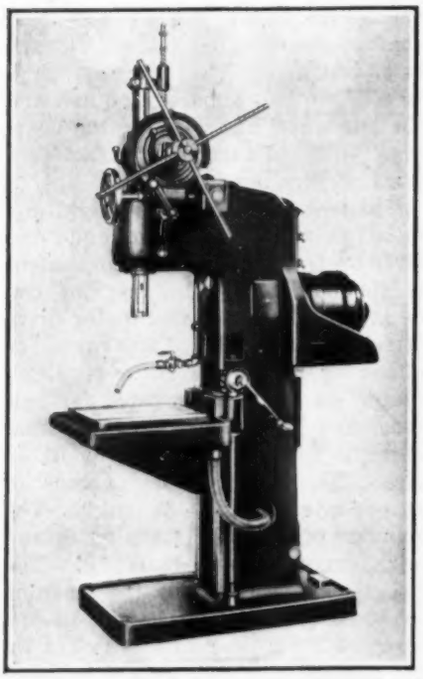


Barnes Production Drilling Machine, No. 340, 20-In.

mounted in large bearings and carrying heat-treated alloy steel gears. The spindle is multiple-splined to correspond and is heat-treated. The driving gear is located at a low position so as to reduce the torsion in the spindle when fully extended.

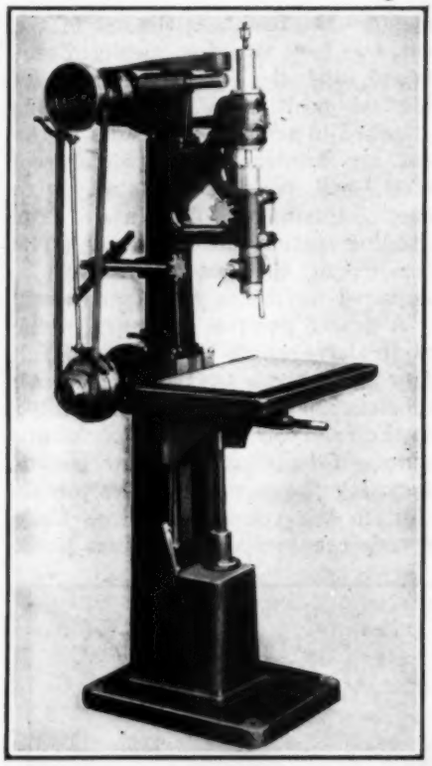
The vertical travel of the table is 16 in. for the single-spindle drill and 12 in. for the gang drills. The spindle travel is 12 in. in each case. The table size is 16x16 in. for the single-spindle machine, while the table sizes for the gang drills range from 16x40 in. for the 2-spindle machine to 16x136 in. for the 6-spindle machine.

"Demco" Sensitive Drill, Model D

The Merit Oil Equipment Co., Cleveland, Ohio, has brought out the sensitive drill shown in the illustration, and known as the model D.

In place of the usual sliding head, the vertical adjustment of the spindle is obtained by means of a quill, in which it is confined endwise. The quill can be moved up or down and clamped in any position. The spindle is made of high-carbon steel, and it runs in ball bearings of both radial and thrust type. It is counterbalanced by a coil spring inclosed in a shell at the top of the machine. In addition to counterbalancing the spindle, the spring keeps the ball races in contact with the balls and takes up lost motion due to downward wear.

The machine is driven by two endless belts, one on the cone pulleys for changing the speed, and the other for driving the spindle from the shaft carrying the upper cone pulley. This latter belt passes over a spring-



"Demco" Sensitive Drill, Model D

tension idler, which automatically compensates for any stretch in the belt that may have taken place.

The table slides on the column and is adjusted by a screw, operated through a crank and bevel gears.

The drill can be furnished in a floor type, as shown, or on a low base for the bench. In the latter type, it can be furnished either in single or in multiple spindles up to six.

Trade Catalogs

Furnaces, Salt Bath. A circular has been issued by the Gilbert & Barker Manufacturing Co., Springfield, Mass., dealing with the use of the salt bath in heat-treating. Two models are illustrated and described, and a salt bath furnace installation is pictured in the circular.

Lathes, Stub. Sundstrand Machine Tool Co., Rockford, Ill. A twenty-four page, 8½x11-in. general catalog has been issued by this company to describe the Sundstrand general purpose stub production lathe. The catalog is unusually complete in its description of the tooling possibilities of the machine, production capacity, and details of construction.

Many line drawings and photographs are used in the description of the construction of the machine and also for illustrating typical tool set ups. The requirements of these typical jobs and the production statistics are given. Speed and feed data are included in the catalog.

Motors, Electric. Century Electric Co., St. Louis, Mo. New instructions, recommendations, and specification sheets have been issued by this company, covering the type RS and SC motors. The sheets supersede those dated July 20, 1926.

A circular has also been issued by this company, describing the Century repulsion-start induction, single-phase motors. A test run of the motors is described and illustrated in this bulletin.

Motors, Vertical. General Electric Co., Schenectady, N. Y. Bulletin No. GEA-470 describes briefly and illustrates the type BD and CD, constant-speed, direct-current vertical motors. A line drawing is used to show the details of construction of these motors.

Trucks, Hand. The American Pulley Co., 4200 Wissahickon Ave., Philadelphia, Pa. A small booklet of twenty pages has been issued by this company to describe the line of American pressed steel trucks manufactured by this company. Each model of the hand trucks is illustrated and a table of specifications gives the details for each model included in the booklet. A general description of the design of the trucks is included.

Valves and Pipe Fittings. The Kennedy Valve Manufacturing Co., Elmira, N. Y., has issued catalog No. 48, covering the general line of products made by this company. The catalog contains two hundred and four, 5x8-in. pages.

Among the products described and illustrated, are: gate valves, globe and angle valves, check valves, electrically operated gate valves, back-water and sewer-gas valves, malleable-iron, cast-iron and brass pipe fittings, pipe accessories and tools, and reducing flanges.

Welding Machines. The General Electric Co., Schenectady, N. Y., has issued bulletins No. GEA 454 and 455, describing automatic arc welding apparatus for small and large tanks, respectively. Complete description are given of the control and operation of the machines and illustrations and drawings are used to show the construction details. Specifications are also included in the bulletins.

Steel Treaters Hold Greatest Machinery Exposition and Convention in Chicago

Three hundred and sixty-five exhibitors—Seventy-five thousand attend—Use of ball bearings, pneumatic chucking and labor-saving devices is notable feature—J. Fletcher Harper for president

"BIGGER and better than ever" is again descriptive of the steel treaters' show. Three hundred and sixty-five exhibitors displayed machine tools, heat-treating equipment, and related products at Chicago. The exposition was the largest ever held on the Municipal Pier, and surpassed any machine-tool show of recent years. It was claimed by many to be the largest machine tool exposition ever held. There was no doubt that the display of heat-treating equipment has never been surpassed.

This year's convention and exposition is the eighth annual event of its kind under the direction of the American Society for Steel Treating. The ninth will be held in Convention Hall, Detroit, Sept. 19 to 23, inclusive, 1927.

Equipment in Operation

Municipal Pier, with concrete floor and ventilated, monitor-type roof, was converted into a large machine shop consisting of a single bay 68 ft. wide and 2,700 ft. long, with 80,000 sq.ft. of floor space occupied. There were two aisles, with a row of exhibits along each wall, and two rows between the aisles. Practically all of the machine tools were in operation, either on demonstration cuts or on production work. Furnaces were engaged on actual work or were at least heated.

By actual count 60,000 people passed through the gates during the first four days. Based on the average daily attendance indicated by those figures, the estimated total attendance was about 75,000. There were 8,500 registrations during the first four days. According to statements made by the exhibitors, the visitors contained a high percentage of the men who buy or influence the buying of equipment. Prospect lists of considerable size were compiled, and sales were reported in good number.

The following officers for the A.S.S.T. for the ensuing year have been nominated: For president, J. Fletcher Harper, research engineer, Allis-Chalmers Manufacturing Co., Milwaukee, Wis.; for vice-president, F. G. Hughes, vice-president, New Departure Manufacturing Co., Bristol, Conn.; for secretary, W. H. Eisenman; for members of the board of directors, J. Hunter Nead, chief metallurgist, American Rolling Mill Co., Middletown, Ohio, and Leslie D. Hawkridge, Halcomb Steel Co., Boston, Mass.

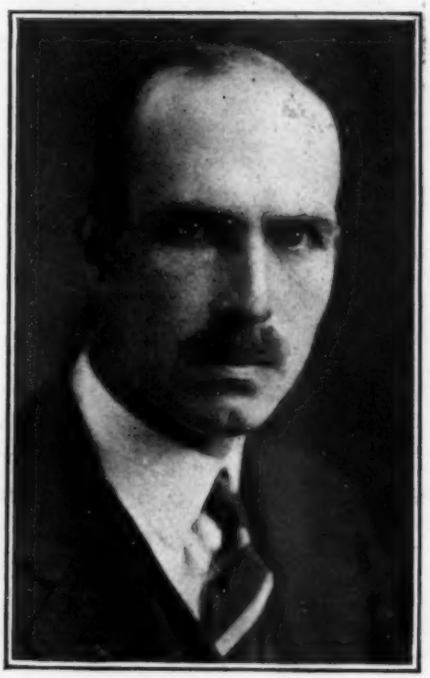
That the exposition covered the machinery, small tool and heat-treating equipment field comprehensively is indicated by the great number of types of machine tools and other equipment shown. They included:

Drilling; milling; lapping; screw; tapping; forging; sawing and metal-cutting; jig-boring; horizontal boring, drilling, and milling machines.

Grinders, planers, shapers, lathes, turret lathes, die sinkers, arbor presses, hammers, boring mills, punch presses.

Shearing; automatic chucking; riveting; engraving; centering; slitting; hobbing; bending; straightening; nibbling; and die-casting machines.

Tooth-grinding; chip-crushing; honing; oil-extracting; belt-lacing; saw-



J. Fletcher Harper

sharpening; balancing; testing; slotting; broaching; drill-pointing and thinning; spring-making; cuttingoff; and flame-cutting machines.

Electric buffers, drills, screw drivers, and tapping machines; steam turbines; portable pneumatic tools; pumps; blowers; cooling fans; forges; metal-cleaning and washing machines; welding and cutting equipment.

Motors; hydraulic feeding devices; drilling heads; compressors; sand-blasting equipment; flexible-shaft equipment; industrial X-ray equipment; high-speed grinding spindles.

Steels, alloys, dies, hand and machine small tools, twist drills, toolholders, taps, vises, die-stocks, wrenches, saws, ground-thread articles, contour-measuring projectors, bearing metals, and castings.

Forgings, belting, cutters, hobs, drop-forged tools, abrasives, screw machine products, alloy-steel products, mercury-vapor lamps, chucks, rust preventives, electric hoists, drop forgings, speed reducers, springs, tapping attachments, chain drives, lubricating devices, ball bearings, roller bearings, die castings, transmission equipment, keys and pins, cutting oils, demagnetizers, shapes.

Hardening furnaces, annealing furnaces, tempering furnaces, lead-pot and cyanide-pot furnaces, electric furnaces.

Heating elements, insulation, metallographic equipment, microscopes, carburizing compounds, fire-brick, hardening compounds, tempering compounds, annealing compounds, refractories, temperature measuring and controlling devices, compound cleaner and grader, carbonizing boxes, gas burners.

Without attempting to mention all of the trends in the design of machine tools, the increased application of certain features was easily noticeable, namely, roller and ball bearings, especially on spindles; power-traversing mechanisms; pneumatic chucking and work-handling devices; and hydraulic feeds.

Automatic Control Increased

There has been an increased effect from the builders' constant efforts to reduce the amount of manual labor necessary to operate the machines; transfer skill from operator to machine; bring about complete automaticity where justified; and to provide extra strength and rigidity to make possible higher cutting speeds and heavier feeds.

Cutting tools have been made stronger. Inserted-tooth milling cutters with bodies of heat-treated steels, forming and other special cutting tools were in evidence.

As at Cleveland last year, the production meeting of the Society of Automotive Engineers and a meeting of the Chicago section of the American Society of Mechanical Engineers were held during the week of the exposition. The A.S.S.T. held its usual group of technical sessions, at which the following papers were presented:

"The Importance of Cementite," by R. G. Guthrie, People's Gas Light and Coke Co., Chicago, Ill.

"Electric Annealing of Magnetic Materials for Telephone Apparatus," by W. A. Timm, Western Electric Co., Chicago, Ill.

"An Efficient Carburizing Furnace of the Surface Combustion Type," by Dr. A. E. White, University of Michigan, Ann Arbor, Mich., and E. R. McPherson, Packard Motor Car Co., Detroit, Mich.

"Observations on the Microstructure of Path of Fatigue Failure in a Specimen of Armco Iron," by F. F. Lucas, Bell Telephone Laboratories, New York.

*"Fatigue Strength of Hard Steels and Their Relation to Tensile Strength," by J. M. Lessells, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

*"Corrosion Fatigue of Metals as Affected by Chemical Composition, Heat-Treatment and Cold-Working," by Dr. D. J. McAdam, Jr., United States Naval Academy, Engineering Experiment Station, Annapolis, Md.

"High-Speed Steels," by F. C. A. H. Lantsberry, Wm. Jessop & Sons, Ltd., Brightside Works, Sheffield, England.

"Hair Cracks in Steel Rails," by J. H. Whitley, South Durham Steel and Iron Co., Ltd., Malleable Works, Stockton-on-Tees, England.

"Solidification of Steel in the Ingot Mold," by Alex L. Field, United Alloy Steel Corporation, Canton, Ohio.

"Desulphurization of Steel," by E. J. Lowry, Hickman, Williams Co., Chicago, Ill.

"Basic Open-Hearth Practice," by C. H. Herty, Jr., Bureau of Mines Experiment Station, United States Department of Commerce, Pittsburgh, Pa.

"Notes on the A_3 Stable Transformation," by H. A. Schwartz, National Malleable and Steel Castings Co., Cleveland, Ohio.

"Graphitization at Constant Temperature Below the Critical Point," by H. A. Schwartz and H. H. Johnson, National Malleable and Steel Castings Co., Cleveland, Ohio.

"The Graphitizing Behavior of Iron Carbide in Pure Iron-Carbon Alloys in the Critical Range," by H. P. Evans and Anson Hayes, Iowa State College, Ames, Iowa.

*"Mechanical and Machining Properties of an Annealed Cast Iron," by G. C. Priester and F. J. Curran.

"On the Corrosion-Resistance of Steels," by Dr. William M. Guertler, Germany.

"The Iron Molybdenum System," by W. P. Sykes, General Electric Co., Cleveland, Ohio.

*"Cyanide Brittleness," by V. E. Hillman and E. D. Clark, Crompton and Knowles Loom Works, Worcester, Mass.

"Wear Resistance of Carburized Steel Versus Cast High-Manganese Steel," by W. J. Merten, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

*"Wear of Steels with Particular Reference to Plug Gages," by H. J. French and H. K. Herschman, Bureau of Standards, Department of Commerce, Washington, D. C.

*"Studies on Electric Welding," by L. J. Weber, University of Minnesota, Minneapolis, Minn.

"On the Transformation of Retained Austenite into Martensite by Stress," by Dr. Kotaro Honda and Keizo Iwase, Tohoku Imperial University, Sendai, Japan.

*"The Nature of Oil-Hardening, Non-Deforming Tool Steels," by E. C. Bain, Union Carbide and Carbon Research Laboratories, Inc., New York, N. Y., and M. A. Grossmann, United Alloy Steel Co., Canton, Ohio.

"The Hardening of Metals by Dispersed Constituents Precipitated from Solid Solutions," by R. S. Archer, Aluminum Co. of America, Cleveland, Ohio.

"Investigation of the Relationship Between the Standard Tension and Impact Tests on a Group of Steels of Varying Compositions," by Dr. F. C. Langenberg and H. C. Mann, Watertown Arsenal, Watertown, Mass.

"The Decomposition of the Austenitic Structure in Steels," by Dr. R. L. Dowdell and Dr. O. E. Harder, University of Minnesota, Minneapolis, Minn.

"On the Light Metal Alloys," by Dr. William M. Guertler, Germany.

*"The Tensile Properties of Stainless Iron and Other Alloys at Elevated Temperatures," by P. G. McVetty and N. D. Mochel, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

W. H. Eisenman

"Investigation of Bolt Steels," by V. T. Malcolm, the Chapman Valve Manufacturing Co., Indian Orchard, Mass.

"Internal Stresses in Quenched Steel," by Dr. S. L. Hoyt, General Electric Co., Schenectady, N. Y.

"Aluminum Bronze," by Jerome Strauss, U. S. Naval Gun Factory, Navy Yard, Washington, D. C.

"New Process of Surface Hardening Special Steels," by T. H. Nelson, Ludlum Steel Co., Watervliet, N. Y.

*"Standardizing the Brinell Hardness Test," by H. M. German, Universal Steel Co., Bridgeville, Pa.

"On the Hardness of Metals," by Dr. William M. Guertler, Germany.

"Correlation of Magnetic Properties with Mechanical Hardness in Cold-Worked Metals," by S. R. Williams, Amherst College, Amherst, Mass.

"Additional Notes on the Hardness and Toughness of High-Speed Steel," by Robert K. Barry, the Barry Co., Muscatine, Iowa.

The chairman of the technical sessions were Prof. Albert Sauveur, Dr. G. K. Burgess, Dr. Zay Jeffries, Prof. Bradley Stoughton, Prof. H. M. Boylston, Dr. V. O. Homerberg, Dr. A. E. White, T. D. Lynch, F. P. Gilligan and W. J. Priestley.

T. E. Barker, chairman, opened the convention by extending the welcome of the Chicago chapter. T. V. Purcell, general chairman, also made an address of welcome to which R. M. Bird, president of the society, responded.

An informal dance was one of the social features of the convention. Another was the smoker and anual frolic, and a third was the annual banquet. Special entertainment features were provided for the ladies.

Plant inspection was by no means lacking. Among the plants visited were those of the Buda Co., Wyman-Gordon Co., Miehle Printing Press and Manufacturing Co., American Forge Co., Tractor Works of the International Harvester Co., West Pullman Works of the International Harvester Co., Youngstown Sheet and Tube Co. (Indiana Harbor, Ind.), Inland Steel Co., Standard Forgings Co., Pettibone Mulliken Co., Strom Bearings Co., Western Electric Co., Interstate Iron and Steel Co., Illinois Steel Co., Pyrotung Manufacturing Co., Illinois Central R.R. Shops, Pullman Car Works, Columbia Tool Steel Co., American Manganese Steel Co., A. Finkl & Sons Co., and Aetna Ball Bearing Co. A trip was made through the Armour Institute of Technology.

Dr. William Minote Guertler delivered the first E. D. Campbell Memorial lecture, established by the A.S.S.T. in memory of the late honorary member, E. D. Campbell, of the University of Michigan. Dr. Guertler is of German birth and was educated at the Institute for Technology in Hanover and Munich, and at the Universities of Munich and Göttingen. His research work in connection with alloys is famous. He is the founder of the "International Journal of Metallography," and the "Deutsche Zeitschrift für Metallkunde." He is now director of the "Metall-Institut of Technischen Hochschule," Berlin. The subject of Dr. Guertler's lecture was "On the Corrosion Resistance of Steels."

At the banquet on Thursday evening honorary membership was conferred upon Elbert H. Gary, chairman of the board of the United States Steel Corporation, and upon Charles M. Schwab, chairman of the board of the Bethlehem Steel Corporation. Founder membership was given to Arthur G. Henry, secretary and treasurer of the Danly Machine Specialties, Inc., of Chicago.

B. J. Mullaney, vice-president of the Peoples Gas, Light and Coke Co., of Chicago, was toastmaster. Frederick C. Langenberg, superintendent of the laboratories at the Watertown Arsenal, was awarded the Henry Marion Howe Medal. The title of the paper which brought the honor to Mr. Langenberg was, "Effect of Cold Working on the Strength of Hollow Cylinders." William S. Bidle received the past president's medal.

In accepting honorary membership in the society Mr. Schwab emphasized his belief that scientific study and development alone would not or could not achieve the wonders of modern

Papers marked with an * were published in abstract form in the *American Machinist* for Sept. 23, 1926

civilization. He expressed the opinion that whole-hearted co-operation and friendly business relations are most important essentials.

He called attention to the fact that while our country represents only 6 per cent of the world population, it controls 50 per cent of manufacturing production. He marvelled at the display of machinery in connection with the convention and predicted great progress in this industry in the future.

The attendance at the banquet was large, over six hundred being at the tables when the toastmaster called order. Mr. Schwab was represented at the banquet by E. J. Buffington, president of the Illinois Steel Co.

List of Exhibitors

Abrasive Machine Tool Co., East Providence, R. I.
Acme Machine Tool Co., Cincinnati, Ohio.
George Adams & Son, Chicago, Ill.
Air Reduction Sales Co., New York, N. Y.
Ajax Manufacturing Co., Cleveland, Ohio.
Alemite Die-Casting & Manufacturing Co., Chicago, Ill.
Allegheny Steel Co., Brackenridge, Pa.
Charles G. Allen Co., Barre, Mass.
Louis Allis Co., Milwaukee, Wis.
Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
Alto Manufacturing Co., Chicago, Ill.
American Crusher and Machinery Corporation, New York, N. Y.
American Cyanimid Co., New York, N. Y.
American Electric Fusion Corporation, Chicago, Ill.
American Gas Furnace Co., Elizabeth, N. J.
American Machinist, New York, N. Y.
American Metallurgical Corporation, Boston, Mass.
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American Stainless Steel Co., Pittsburgh, Pa.
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American Twist Drill and Tool Co., Detroit, Mich.
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Atlas Press Co., Kalamazoo, Mich.
Atlas Steel Corporation, Dunkirk, N. Y.
Avey Drilling Machine Co., Cincinnati, Ohio.
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Barber Colman Co., Rockford, Ill.
Bardons & Oliver, Cleveland, Ohio.
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W. N. Best Corporation, Dempsey Furnace Division, New York, N. Y.
Bethel Player Co., Westboro, Mass.
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Billings and Spencer Co., Hartford, Conn.
Bilton Machine Tool Co., Bridgeport, Conn.
Black and Decker Manufacturing Co., Towson, Md.
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Blake and Johnson Co., Waterbury, Conn.
G. S. Blakeslee & Co., Chicago, Ill.
Blanchard Machine Co., Cambridge, Mass.
Botfield Refractories Co., Philadelphia, Pa.
Boyle Valve Co., Chicago, Ill.
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.
Bristol Co., Waterbury, Conn.
D. P. Brown & Co., Detroit, Mich.
Brown and Sharpe Manufacturing Co., Providence, R. I.
John Brown Boiler Co. of Ill., St. Louis, Mo.
Brown Instrument Co., Philadelphia, Pa.
Brown Lynch Scott Co., Monmouth, Ill.
Bryant Chucking Grinder Co., Springfield, Vt.
Buckeye Portable Tool Co., Dayton, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Bullard Machine Tool Co., Bridgeport, Conn.
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Carborundum Co., Perth Amboy, N. J.
Carlton Machine Tool Co., Cincinnati, Ohio.
Carpenter Steel Co., Reading, Pa.
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Celite Products Co., Los Angeles, Calif.
Central Alloy Steel Co., Massillon, Ohio.
Chambersburg Engineering Co., Chambersburg, Pa.
W. R. Chapin Co., Indianapolis, Ind.
Char Products Co., Indianapolis, Ind.
Chicago Pneumatic Tool Co., Chicago, Ill.
Chicago Screw Co., Chicago, Ill.
Chicago Steel Foundry Co., Chicago, Ill.
Cincinnati-Bickford Tool Co., Cincinnati, Ohio.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cincinnati Planer Co., Cincinnati, Ohio.
Cincinnati Shaper Co., Cincinnati, Ohio.
Cisco Machine Tool Co., Cincinnati, Ohio.
Clark Equipment Co., Buchanan, Mich.
James Clark Jr. Electric Co., Louisville, Ky.
Clark Tructractor Co., Buchanan, Mich.
Cleveland Automatic Machine Co., Cleveland, Ohio.
Cleveland Planer Co., Cleveland, Ohio.
Cleveland Twist Drill Co., Cleveland, Ohio.
Climax Molybdenum Co., New York, N. Y.
Clipper Belt Lacer Co., Grand Rapids, Mich.
Cochrane-Bly Co., Rochester, N. Y.
Colburn Works of Consolidated Machine Tool Corporation, Rochester, N.Y.
Colonial Steel Co., Pittsburgh, Pa.
Colonial Tool Co., Detroit, Mich.
Columbia Tool Steel Co., Chicago Heights, Ill.
Colt's Patent Fire Arms Manufacturing Co., Autosan Division, Hartford, Conn.
Cone Automatic Machine Co., Springfield, Vt.
Consolidated Machine Tool Corporation of America, Rochester, N. Y.
Cooper Hewitt Electric Co., Hoboken, N. J.
Crankshaft Machine Co., Jackson, Mich.
Crucible Steel Co. of America, New York, N. Y.
Cushman Chuck Co., Hartford, Conn.
Danly Machine Specialties, Inc., Chicago, Ill.
Davis Boring Tool Co., St. Louis, Mo.
N. C. Davison Gas Burner and Welding Co., Pittsburgh, Pa.
Dearborn Chemical Co., Chicago, Ill.
Diamond Machine Co., Providence, R. I.
Henry Disston and Sons, Inc., Philadelphia, Pa.
H. L. Dixon Co., Pittsburgh, Pa.
Donner Steel Co., Inc., Buffalo, N. Y.
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Driver-Harris Co., Harrison, N. J.
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Eaton Electric Furnace Co., Taunton, Mass.
Eclipse Fuel Engineering Co., Rockford, Ill.
Edlund Machinery Co., Inc., Cortlandt, N. Y.
Electro Alloys Co., Elyria, Ohio.
Electric Furnace Co., Salem, Ohio.
Electrical Refractories Co., East Palestine, Ohio.
R. E. Ellis Engineering Co., Chicago, Ill.
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Ferry Cap & Set Screw Co., Cleveland, Ohio.
A. Finkl and Sons Co., Chicago, Ill.
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Flather Co., Nashua, N. H.
Foote Bros. Gear and Machine Co., Chicago, Ill.
Foote-Burt Co., Cleveland, Ohio.
J. B. Ford Co., Wyandotte, Mich.
Forging - Stamping - Heat - Treating, Pittsburgh, Pa.
Foster Machine Co., Elkhart, Ind.
Fox Machine Co., Jackson, Mich.
Gairing Tool Co., Detroit, Mich.
Gallmeyer and Livingston Co., Grand Rapids, Mich.
Gammons-Holman Co., Manchester, Conn.
Gardner Machine Co., Beloit, Wis.
W. Gaterman Manufacturing Co., Manitowoc, Wis.
Gathmann Engineering Co., Baltimore, Md.
General Alloys Co., Boston, Mass.
General Electric Co., Schenectady, N. Y.
Geometric Tool Co., New Haven, Conn.
Wm. D. Gibson Co., Chicago, Ill.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gilbert and Barker Manufacturing Co., Springfield, Mass.
J. E. Gilbert Grinder Co., Milwaukee, Wis.
Gisholt Machine Co., Madison, Wis.
Gits Brothers Manufacturing Co., Chicago, Ill.
Goddard and Goddard Co., Detroit, Mich.
Claud S. Gordon Co., Chicago, Ill.
Goss and De Leeuw Machine Co., New Britain, Conn.
Gould and Eberhardt, Newark, N. J.
G. A. Gray Co., Cincinnati, Ohio.
Greenfield Tap and Die Corporation, Greenfield, Mass.
George J. Hagen Co., Pittsburgh, Pa.
Halcomb Steel Co., Syracuse, N. Y.
Hall-Will, Inc., Erie, Pa.
Hammond Manufacturing Co., Cleveland, Ohio.
HandE Wrench Sales Co. of Illinois, Chicago, Ill.
Hanson-Whitney Machine Co., Hartford, Conn.
Heald Machine Co., Worcester, Mass.
Heat Treating Supply Co., Sandusky, Ohio.
Heim Grinder Co., Danbury, Conn.
Heppenstall Forge and Knife Co., Pittsburgh, Pa.
Hevi Duty Electric Co., Milwaukee, Wis.
High Speed Hammer Co., Inc., Rochester, N. Y.
Hi-Power Tool Corporation, Jackson, Mich.
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Holcroft & Co., Detroit, Mich.
Hoover Steel Ball Co., Ann Arbor, Mich.
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Kloster Steel Corporation, Chicago, Ill.
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Kropp Forge Co., Chicago, Ill.
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Landis Tool Co., Waynesboro, Pa.
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R. K. Le Blond Machine Tool Co., Cincinnati, Ohio.
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F. J. Littell Machine Co., Chicago, Ill.
Lodge and Shipley Machine Tool Co., Cincinnati, Ohio.
Logansport Machine Co., Logansport, Ind.
Loshbough-Jordon Tool and Machine Co., Elkhart, Ind.
Ludlum Steel Co., Watervliet, N. Y.
Machine Tool Record, International Trade Press, Chicago, Ill.
Mackintosh-Hemphill Co., Pittsburgh, Pa.
Madison-Kipp Corporation, Madison, Wis.
Mahr Manufacturing Co., Minneapolis, Minn.
Manning, Maxwell & Moore, Inc., Chicago, Ill.
Maplewood Machinery Co., Chicago, Ill.
Marshall & Huschart Machinery Co., Chicago, Ill.
McCrosky Tool Corporation, Meadville, Pa.
McGill Metal Co., Valparaiso, Ind.
Metalwood Manufacturing Co., Detroit, Mich.
Michigan Tool Co., Detroit, Mich.
Micro Machine Co., Bettendorf, Iowa.
Midvale Co., Nicetown, Philadelphia, Pa.
Modern Grinder Works of Consolidated Machine Tool Corporation, Erie, Pa.
Moline Tool Co., Moline, Ill.
Molybdenum Corporation of America, Pittsburgh, Pa.
Monarch Machine Tool Co., Sidney, Ohio.
Morse Twist Drill and Machine Co., New Bedford, Mass.
Morton Manufacturing Co., Muskegon Heights, Mich.
Murchey Machine and Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.
National Electric Light Association, Chicago, Ill.
National Machinery Co., Tiffin, Ohio.
National Twist Drill and Tool Co., Detroit, Mich.
Nazel Engineering & Machine Works, Philadelphia, Pa.
Neff Kohlbusch and Bissell, Chicago, Ill.
New Britain Machine Co., New Britain, Conn.
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O. K. Tool Co., Inc., Shelton, Conn.
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Potter and Johnston Machine Co., Pawtucket, R. I.
Pratt and Whitney Co. Division of Niles-Bement-Pond Co., Hartford, Conn.
Precision Truing and Machine Tool Co., Cincinnati, Ohio.
Production Machine Co., Greenfield, Mass.
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George Scherr, New York, N. Y.
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Steel City Testing Laboratory, Detroit, Mich.
Stockbridge Machine Co., Worcester, Mass.
Stocker-Rumley-Wachs Co., Chicago, Ill.
N. A. Strand Co., Chicago, Ill.
D. A. Stuart & Co., Chicago, Ill.
Sun Oil Co., Philadelphia, Pa.
Sunstrand Adding Machine Co., Rockford, Ill.
Sunstrand Engineering Co., Rockford, Ill.
Sunstrand Machine Tool Co., Rockford, Ill.
Surface Combustion Co., New York, N. Y.
Swedish Crucible Steel Co., Detroit, Mich.
Swedish Iron & Steel Corporation, Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Henry G. Thompson & Son Co., New Haven, Conn.
Thompson Grinder Co., Springfield, Ohio.
Timken Roller Bearing Co., Canton, Ohio.
Union Drawn Steel Co., Beaver Falls, Pa.
Union Electric Steel Corporation, Latrobe, Pa.
Union Manufacturing Co., New Britain, Conn.
Union Twist Drill Co., Athol, Mass.
Unishear Co., New York, N. Y.
United States Electrical Tool Co., Cincinnati, Ohio.
Universal Boring Machine Co., Hudson, Mass.
Universal Grinding Machine Co., Fitchburg, Mass.
Universal Steel Co., Bridgeville, Pa.
Vacuum Belting Co., Indianapolis, Ind.
Vanadium Alloys Steel Co., Latrobe, Pa.
V and O Press Co., Hudson, N. Y.
Van Dorn Electrical Tool Co., Cleveland, Ohio.
Van Norman Machine Tool Co., Springfield, Mass.
Vulcan Crucible Steel Co., Aliquippa, Pa.
Vulcan Mold & Iron Co., Latrobe, Pa.
Walcott Machine Co., Jackson, Mich.
O. S. Walker Co., Inc., Worcester, Mass.
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Warner & Swasey Co., Cleveland, Ohio.
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Whitney Metal Tool Co., Rockford, Ill.
Wilmarth and Morman Co., Grand Rapids, Mich.
Wilsey-Tuthill Pumps, Chicago, Ill.
Wilson-Maeulen Co., Inc., New York, N. Y.
Wisconsin Electric Co., Racine, Wis.
Zeh and Hahnemann Co., Newark, N. J.
Ziv Steel and Wire Co., Chicago, Ill.

Automotive Engineers Feature Four Major Production Subjects

Conveyors, gear production, inspection and machine tools dominate the discussions—Much attention to new tooling methods—Mass production practices—Abstracts of several of the papers

Four important subjects—conveyors, gear production, inspection, and machine tools—dominated the program of the production meetings of the Society of Automotive Engineers at the Hotel Sherman, Chicago, Sept. 21, 22 and 23. The problems of each were well presented and discussed by an interested audience. Abstracts of some of the papers follow this account of the meeting, and others appear elsewhere in the paper.

There were two papers on conveyors, one dealing with shop transportation generally, by Paul Phelps and N. H. Preble, and the other by Clarence R. Brock, showing a number of interesting applications to the automobile industry. Gear steels and gear production were treated by W. G. Hildorf and John Bethune, and by Charles L. Cameron.

The inspection session included papers on line inspection by A. H. Frauenthal and a symposium on special devices and methods by A. R. Fors, P. W. Rhame, J. B. Scott, C. S. Stark, and R. R. Todd. While discussion of inspection subjects was cut short by the trip to the Nash Motor Co. plant, the session was most interesting and many points of value were brought out.

The two papers at the machine tool session were of particular interest to both users and builders of machine tools. The first, on fitting the machine tool to the job, by O. C. Kavle, pointed out the importance of the right machine tool as a factor in economical production, and the advantage of co-operation between the builder and the user. The necessity for prices that will pay for development engineering costs was also brought out forcibly.

E. R. Stoddard's paper was presented by Mr. Longwood, also of the Studebaker Co. It pointed out the cost of machine shut-downs and their causes. These he divided among the machine designers, builders and users as pointed out in the abstract. His idea of keeping machine tools on the job is that the joint responsibility be recognized and that greater co-operation be secured. He expressed his appreciation of the way in which suggestions were received by machine builders.

Ernest F. DuBrul, general manager of the National Machine Tool Builders' Association, discussed both the paper by Mr. Kavle and that by Mr. Stoddard, pointing out that the buyers expected much of the machine tool builder both as to design and performance. He urged that all remember how much the demand for production had increased the task of the machine tool, while the lack of trained men in the shop made it necessary to incorporate the skill of the old mechanic in the machine itself. In

view of the huge losses caused by machine failure in the production line, he pointed out the shortsightedness of haggling over prices of machine tools, as in order to design and build the machines that cut costs and stay on the job, the builder must secure sufficient return to keep his plant running at a profit. He suggested closer contacts between the designers of machines and the men who are to use them, so that the problems pointed out by Mr. Stoddard could be met with less delay and with greater satisfaction.

There were three excursions, to the plants of the Nash Motors Co., Kenosha, Wis., the Yellow Truck and Coach Manufacturing Co., and the International Harvester Co., both of Chicago. There was a stag carnival, which was well attended, as were all the sessions.

Abstracts of papers follow:

Automobile Gear Production

By Charles L. Cameron
Gould & Eberhardt

Since the perfection of grinding the teeth of hobs, which was first accomplished in this country by Gould & Eberhardt, the use of the hobbing principle for generating gears has made rapid advances. Not very long ago a prominent automotive engineer claimed that most of the gear troubles could be attributed to the hobbing machines, and this started a development in spur gear hobbing machines that has revolutionized production by the hobbing process.

Simplified Hobbers

The first construction of the simplified hobbers was built around the idea of having a machine that only had four gears in it, two to drive the cutter and two to drive the work, but this principle involved so many limitations, that out of it has developed a machine that may be referred to as a flexible specialized function machine, not limited to any one gear, but for a number of different gears.

It was found desirable to have enough flexibility in the machine to permit the use of single, double or even triple thread hobs, and to be able to cut a limited range of teeth; in other words, not having a machine so highly specialized that it was adaptable for only one specific gear.

A machine to satisfy the demand for extreme accuracy must be made with the working parts as accurate as possible and to be fitted as perfectly as can be done, but no matter how accurately within the limitation of manufacturing methods the parts may be formed and mounted, each rotating or moving part will contribute a certain amount of error due to its own minor inaccuracy. Where any moving part co-operates with another, there is a certain amount of backlash which accumulates in proportion to the number of parts.

Uniformity of Rotation

In the ideal hobbing machine there should be absolute uniformity of rotation between the hob and work spindle. A great deal has been developed lately in determining the uniformity of the angular velocity of mating gears. Towards this end Gould & Eberhardt have perfected their balanced drive, which means that there are exactly the same number of gears from the prime drive to the cutter spindle as to the work spindle.

The last movers on the cutter spindle and work spindle are worms and worm wheels, the worms being of hardened steel and ground all over with a very high degree of accuracy. Experience over a long period of years has demonstrated the superiority of properly designed worms and worm wheels, as the last mover in each train in a gear cutting machine.

In cutting transmission gears on a hob generating type machine the roughing operation is usually done with multiple thread hobs, while the finishing of the gear teeth is done with single thread ground hobs. Where gears are finished ground, the hob generating method has proven most successful for finishing the teeth preparatory to the grinding operation. The finishing of the teeth before the grinding is done in many shops in one cut using single thread rough ground hobs. Double thread hobs have also been used with success for finishing preparatory to grinding, and it is probable that they will be used on a large scale in the near future, as ground hobs can be produced and duplicated with a high degree of accuracy.

Hobbing Sprockets

Since many makes of cars are being equipped with silent chains for timing, the sprockets, being similar to spur gears, are being hobbed very successfully. The high degree of accuracy of indexing as obtained from a hobbing machine lends itself particularly to the production of silent chain sprockets, and hobs can easily be obtained for giving the correct forms and teeth.

The cutting of helical timing gears has presented more problems in the automobile industry than any other branch of gear cutting, because of the exacting requirements necessary to produce quiet gears. It is a well-known fact that to produce quiet gears, accuracy is of greatest importance otherwise noise is the result. Often times the cause of noisy gears is unjustly blamed on the machine or cutting tool, whereas the true cause was actually in the mounting of the gears.

A gear is a product of the gear cutting machine, the cutting tool and the operator, consequently the gear produced can be no more accurate than the combined accuracy of all these factors. If this statement is kept in mind, as well as exercising care in mounting timing gears, it will go a long way toward eliminating gear troubles.

To improve the accuracy of the hob generating type of machine, special testing devices have been developed to record graphically the accuracy of angular velocity between the hob and the work arbors. With this testing instrument the machine can be perfected to insure almost absolute uniformity of angular velocity between the hob and work, thus producing gears with correct tooth contours and spacings.

Automobile flywheels and starter ring gears are cut by almost all manufacturers by the hob generating method, as advantage can be taken of multiple thread hobs. The vertical type of machine has proven most successful on this work as the gear blanks are supported in a horizontal plane and can be stacked. This is particularly true in cutting starter ring gears when a number of blanks can be cut per setting by stacking one on top of each other.

The cutting of automobile steering worm wheels is best adaptable to the hob generating method, being cut by the method of feeding the work into the hob or vice versa. The hobs used vary widely, depending upon the individual experience of the different plants. Some companies use single thread hobs, others double, while some even use quadruple-thread hobs. In using single-thread hobs the hob is made of a larger diameter than the worm, and is swiveled or set off at an angle to suit the helix angle of the gear teeth to be generated. With this practice a spot or center bearing is produced on the gear teeth, which has worked out satisfactorily for a steering apparatus.

Hobbing Splines

Since the development of hobs a serious problem has been solved in cutting rapidly and accurately the castellations on drive shafts and universal stub shafts. The advantages of this method are being recognized more each day because of the accuracy possible. Not only are the splines spaced more accurately, but the thickness can be maintained at the roots as well as the tops. They are also held parallel within a closer limit.

The Human Gage

By R. R. Todd
Oakland Motor Car Co.

No mechanical gage has, as yet, taken the place of the human element in many inspection operations. Measurements can be taken with sufficient accuracy but when it comes to inspecting gears and similar units, or complete engines, for noise, there is no standard than can be depended upon. Not over one man in five hundred has a sufficiently keen sense of hearing to be trusted with inspection of this kind. Men who pass work as satisfactory one day, may reject the same units the next day. The sense of hearing seems to vary with the feeling or temperament of the man.

The Oakland plant has adopted the plan of having standard units that are satisfactory as to noise and of using these units to check against. The in-

spector periodically runs one of these standard units as a comparison and passes or rejects new work in accordance with the standard.

The inspection of paint and other finishes is also subject to the difficulties involved in depending entirely upon the judgment of the individual.

Fitting the Machine Tool to the Job

By O. C. Kavle

Manufacturers' Consulting Engineers, Syracuse, N. Y.

Unfortunately manufacturers in the automotive industry are, in general, unwilling to pay the costs of developing special machines, and do not always realize that any machine-tool builder, in developing such a machine, may not always get it exactly right at first. In such a case they are too prone to think that he has failed and to go to some other machine-tool builder with the problem, perhaps only to have another failure, whereas the first builder, by reason of his first failure, is in a better position to build the machine right the second time, and at least cost.

Someone must pay for the development work on machine-tools. The cost of duplicating the perfected machine does not represent its true cost, and the builder is not able to stand the difference. If every such machine tool could become a standard machine that would be in large demand, the builder might recover his losses on the first one, but very often the special machine is suitable for use by only a single customer and on only one production piece. Therefore, the customer should pay all the costs of developing it and enough more to allow the builder to realize a reasonable profit.

Fewer Design Changes

We believe that the automobile industry has come to that stage in its production where the radical changing of design is becoming less each year, and the production manager can consider more simplified production in his plant. The tendency in a great many cases has been to buy large, complicated machines to perform operations that could be done on much simpler units, because the machines have been stock products.

We were called upon at one time to analyze cylinder drilling operations that required 13 min. and produced a scrap loss of from 25 to 30 per cent, which was called a foundry loss because of the inability of foundries to make all castings alike. We regard it as the production engineer's problem to save all the castings he can, regardless of slight discrepancies the foundry is likely to make. In the instance mentioned, by rearranging the locating points for the drilling operation the scrap loss was reduced to less than 2 per cent and, due to the reduction of this scrap loss, the average time for the operation per cylinder was reduced by 10 min.

On another occasion we were called upon to find the cause of a scrap loss that ran to from 40 to 50 per cent due to spoiled block castings for six-cylinder engines. A study of the operation showed that the trouble arose in the first machining operation, which was the milling of the base and ends, as the cut was not being made square to the outside of the cylinder. Correction of this not only increased the production but improved the quality of the whole cylinder-block.

The elimination of handling time whenever possible is emphasized, because if the handling of the material can be timed with the machining operations it may mean that the cutting speed can be slowed down to meet the handling time and thereby effect a saving of tool wear or the handling of the work can be speeded up to keep pace with the cutting speed. The important object with all production tools is to keep the cutting tools constantly producing chips. Whenever the tools are not making chips they are not producing. It is not possible in all production work, of course, to keep the cutting tools at work all the time, but that is the main point that we have in mind when making an analysis of any production problem.

We have been cold-pressing forged connecting-rods to size instead of milling them. This gives a good surface, and to insure absolute accuracy on the surfaces at the big and small ends, we have been doing a very slight grinding operation. This method produces a high-class finish at very low production cost. The most serious trouble that has been experienced with the cold-pressing has been getting the forge shops to hold sizes within close enough limits.

The machining of crankcases, especially aluminum castings, by the grinding operation is recommended wherever it is possible in preference to the milling operation. This is because the crankcase, as prepared for the grinding operation, can be from 3 to 4 lb. lighter than the same crankcase as prepared for the milling machine, due to the fact that any cutter with which a crankcase can be machined must go under the scale to avoid the sand and other abrasive left on the outside, which is sure to ruin the cutting edge of the tools. Since the extra aluminum has to be paid for at a certain price per pound it costs about one-tenth as much to remove this extra stock as is paid for the excessive weight.

Special Machine Designs

A simplified machine for machining the crankshaft and camshaft bearings in crankcases has been designed. It is especially noteworthy for the small amount of space it occupies on the floor. The crankcase is mounted differently for machining than in any other machine of which I know, with the fixture above the work to enable the operator to see the operation of the tools. This has worked out very satisfactorily and has also proved to be a very quick way of loading the work into the machine. At the right-side is a self-contained driving unit that drives and feeds the boring bar at the predetermined rate. An extra driving head can be carried in stock to exchange with one in use at any time when it becomes necessary, so that the machine can be kept in actual production operation nearly 100 per cent of the time.

The solution of a problem in oil-hole drilling on crankshafts will doubtless be of interest. The holes are drilled diagonally from the crankpins through the checks and main-line bearing, and two pairs of holes are drilled in three different directions. Three are drilling machines used for these operations, each machine carrying two drills that drill two holes in the same direction. Each machine drills in a different direction from the others. These machines have been running very successfully for a number of years, and one operator on the three machines does the work on 50 crankshafts per day.

Radio Amplification for Inspection Purposes

By C. S. Stark

Packard Motor Car Co.

The most uncertain problem that the inspection branch has to contend with is that part of inspection relying entirely on the judgment of individuals. In other words the judgment on the kind of workmanship that cannot be measured by mechanical means, but which must rely entirely on one or more of the five senses.

With that end in view, we began several years ago to search for some means of checking up surface finishes accurately by mechanical means. It occurred to us that possibly the use of photo microscopic pictures would give us a lead. After conducting many experiments and taking many pictures of representative samples of variations that the eye could detect, we did not arrive at any very conclusive results. We even went so far as to use up to one hundred magnifications without receiving any great encouragement. However, the microscopic photographs did point out the interesting fact that the higher degree of surface finish produced a decidedly narrow sharp band of bright light in the photograph, whereas, surface finishes of a lesser degree of polish produced a very wide band.

It is a recognized fact that reflection intensity is proportional to the degree of the surface finish. We found that

it was possible to purchase a photo-electric cell, which is nothing less than a detector bulb. This bulb responds instantaneously to minute variations in light intensity. We found that these cells are used regularly in telegraphic picture transmissions. We found that when the cell is connected in a suitable amplifying circuit to a milliammeter, the ratio of the values read on the output milliammeter gives accurately the degree of the polish on the surface of the sample that is being tested, when the sample is exposed to a source of light and the light reflected against this cell. Of course, this becomes primarily a method of comparison and a standard must be adopted at which the value is to be established, and then the parts to be compared are read mechanically from the deflection in the milliammeter. The deviation from the standard is taken as the reading.

Referring to the diagrammatic hook-up of this outfit, the amplifier is the usual 201-A type. With this tube a 6-volt battery should be used to light the filament. A filament control rheostat is used for regulating the potential on the filament of the amplifier tube. The potential should be adjusted to 5 volts for most satisfactory operation. There is a shunt provided which should remain open when working with light of high intensity. With light of low intensity, the shunt should be closed. A variable high resistance unit is introduced in order to be able to vary the current constantly. This instrument is not at all expensive, and the results obtained from it have been well worth the expenditure.

Transportation by Conveyor

By Paul Phelps and N. H. Preble
Mechanical Handling Systems, Inc.

The production of the modern automobile, while presenting many complex problems, can be reduced in principle to a certain few fundamental operations. These operations can be roughly and briefly outlined as follows: the receiving and storage of raw materials; the transportation of this material to the machine shop, forge, foundry or other manufacturing department; the machining, forging or fabricating of the individual parts; the transportation of these parts to the sub-assembly; the sub-assembly operations, such as motor, axle, transmission, body assembly and the like; the transportation of the various sub-assemblies and finished parts to the final assembly; and the final assembly, testing and shipment of the completed car.

In all these operations, conveyors or mechanical handling systems play a major and important part, for transportation in one form or another is almost as big a factor as the actual making. In the short time at our disposal, it is manifestly impossible to fully describe all of the varied applications of mechanical handling equipment. All we can hope to do is to describe some particular problems and the means taken in their solution.

Savings by Conveyors

When we consider that the cost of an electrical horsepower employed in the moving of material is roughly a few cents an hour, while the man horsepower is in the neighborhood of 50c. an hour, we can immediately visualize important possible savings. An instance of this is shown in an installation of conveyor equipment for handling rough castings from the receiving dock to the machine shop in an axle plant. All incoming stock must be received from the outer of three spur tracks. The center track is largely taken up by switching, while the inner track must be reserved for outgoing shipments. Formerly all castings were handled hand to hand, either through or around the cars from the receiving dock to the machine shop. Two conveyors have replaced this method and they paid for their entire installation in a few months.

The conveyor installed is a double strand, trough and drag type, with channel flights discharging onto a swinging chute which feeds into bins handled by lift trucks to the various machine tools.

In general it should be recognized that any system of floor trucking is almost sure to produce one or more tight spots where congestion and attendant delay will occur. Also floor space represents a capital investment which should be productively utilized. By some system of mechanical handling, congestion of this sort can often be avoided and the floor space left clear for productive operations. This case just described is merely a case of stock handling. Other problems can perhaps be better served by gravity rollers, cranes or hoists, or different adaptations of the conveyor principle.

Tote Box vs. Conveyor

In the machine shop itself, the transportation of individual parts from machine to machine is most frequently left to the tote box or truck and hand power. In one shop a monorail conveyor runs over the machine tools, inspection and assembly benches. As each operation is completed, the pieces are hung on the hooks, suspended from the monorail chain and carried to the following operation. The entire equipment is hung from the ceiling and the floor is left clear of all material.

Where heavy parts are to be handled, such as cylinder blocks, the use of gravity rollers will facilitate the moving of material and in many cases will decrease considerably the lifting required. This type of conveyor will not, however, effect a full saving in floor space.

The concentration of sub-assemblies and parts at the final assembly line frequently presents a difficult problem. One instance of this is in a plant manufacturing motors. The motors are now transferred from the assembly conveyor by means of a hand-pushed trolley system to the storage loop in a dynamometer room. As wanted, they are picked up by air hoists on trolleys running over the test stands and carried into position for testing. After the test, other hoists pick up the motors and transfer them to another monorail which runs alongside the silent test booths with a track into each booth. After silent test, the motors come out on the same track, pass through a paint booth, and then under a crane over the storage racks. Here they are stored as required until transferred again by a second crane to monorails passing over the final assembly lines. Front and rear axles are brought in by trucks and also carried over the assembly conveyor by means of monorails.

The handling of rear axles after final assembly is another instance. In this installation, the axles, after coming off the assembly conveyor are hung on hooks suspended from a monorail chain with the open end of the third member inserted into a tube with a closed top. The axles first pass through a steam chamber, thence after forced drying, to the paint spray where they are automatically sprayed. The conveyor then turns back into the drying oven, the elevation of the conveyor being such as to give full head room underneath. After drying, the axles are carried direct to the shipping dock for shipment to the assembly plants, but the same kind of equipment could be used direct to the final assembly. The length of the line, together with close spacing of the carrying hooks, results in considerable storage acting as a cushion in case of shut down of the final assembly through any cause.

The actual dollars and cents savings produced by these various installations cannot always be determined. Often the indirect returns in improved conditions, increased production and the like, may be even greater than the direct labor saved. In general, however, the return obtained from the investment in mechanical handling equipment is surprisingly large. A recent conversation with a plant engineer disclosed the fact that conveyor installation costing over $80,000, had fully paid for itself in less than six months of operation and was at that time saving about $800 a day. This is a return of 300 per cent on the initial investment. You would grab at the chance of a safe return on your money of 10 per cent a year. Isn't it well worth while considering the installation in your own plant, of equipment certain to give you a larger return?

What Goes Wrong with Machine Tools in Automobile Production

By E. R. Stoddard
Studebaker Corporation

After pointing out that a complete stoppage of the production line would cost the Studebaker Corporation $4,000 an hour in net profits, he named three principal causes of machine failure. Of first importance is the lack of lubrica-

tion, due either to the failure of the builder to provide adequate oiling facilities, to oil holes becoming clogged or hidden by chips or to neglect by the operator. Second is the fault of operators or foremen in overloading a machine, failure to change cutters at the first sign of dullness, carelessness in clamping work or in leaving wrenches where they can get into the working parts, and other similar neglects. Less frequently, but still a cause for criticism, is the lack of sufficient care in design and construction.

Mr. Stoddard advocates positive, forced feed lubrication wherever possible. Reservoirs with sight feed are also advocated, with copper tubes running to each bearing. Insufficient chip room is also cited as a defect, both because it frequently obstructs oil holes and also jams the working parts of the machine. Large, loose pulleys that will carry 24-hr. lubrication are also suggested.

Interlocking speed and feed changes are considered indispensable to prevent serious damage to machines. Shear pins should be more in evidence as a safety device. Parts of standard machines not needed for the special job for which the machine is tooled, should be removed from the machine, boxed separately and labelled so that they can be used at a later time if needed.

Mr. Stoddard feels that there is a joint responsibility in which designers, builders, foremen and operators all share and that all should co-operate to the fullest extent possible.

Machine-Shop Practice Division of A.S.M.E. in Chicago Session

Standardizing, inspection and foreman training are topics

The machine-shop practice division of the American Society of Mechanical Engineers held its technical session Thursday, Sept. 23, at the Drake Hotel, Chicago. Frank W. Curtis, Western Editor of the *American Machinist*, presided as chairman. The program for the meeting consisted of four papers which were as follows:

"Drop-Forging Hammer Anvils," by Eugene C. Clarke, Chambersburg Engineering Co., Chambersburg, Pa.

"The Possibilities of Standardizing Design Details in Plants Manufacturing Special Machinery," by H. K. Keever, McDonald Machine Co., Chicago, Ill.

"Modern Inspection Methods," by E. D. Hall, superintendent inspection development, Western Electric Co., Chicago, Ill.

"Foremanship Training," by Hugo Diemer, director of industrial courses, La Salle Extension University, Chicago Ill.

Some of the subjects treated were standard specifications and tolerances; the development of equipment and methods that will enable inspectors of ordinary ability to make precise measurements and tests rapidly and with satisfactory results; the design and use of automatic gaging and testing apparatus; inspection work in connection with pace-setting equipment, such as belt conveyors; operation tests of telephone apparatus; optical projection methods for inspecting contours and for amplifying the measurements of small dimensions; the uses of photo-electric cells and vacuum tubes in the amplification of measurements; and the translation of visible indications into audible signals and mechanical controls.

Abstracts of the papers by Mr. Keever and Mr. Diemer are published in this issue of the *American Machinist*.

Mr. Hall's paper dealt with the fundamentals and developments of inspection work as a function of a manufacturing department and stated that its place in an organization is controlling the quality of the product, maintaining standards, reducing losses by early discovery of poor materials or workmanship, controlling piecework payments and furnishing reports to assist in executive control.

Foremanship Training

By Hugo Diemer

Director of Industrial Courses, La Salle Extension University

It is generally conceded that the foreman is the man to whom the management must sell its ideas in connection with production or personnel management before these ideas or plans can become thoroughly effective. To prepare the foreman so that he can be "sold" the ideas of the management and so that he will appreciate what the management is trying to sell him and will understand the aims, is in itself a big problem. Foremanship training is worthwhile if it can accomplish this.

With the development of new methods and functional staff specialization in control of production and in personnel management, it became necessary to take away some of the old-time duties and activities of the foreman. It is the work of management today to prove that the newer type of organization helps the foreman to higher responsibilities through relieving him of routine and really makes him a bigger man.

The manner in which the installation of methods resulting from some of these developments has been carried on has gone considerably toward confusing and alienating the foreman. The prevention of this tendency was not provided for. If we destroy the self-confidence of the foreman, we have crippled him. Foremanship developed not as a scheme to give the foreman an education, but as a medium for showing respect for what the foreman is and for what he can do. If the foreman realizes that the management is building on respect for him, the foreman will do his share.

The responsibilities for better foremanship rest primarily with management itself. Before much can be accomplished with the foreman, management must accomplish a great deal with itself. Any industrial official who asks that his foreman possess attitudes and traits which he does not possess himself will only complicate matters. The human relation factor cannot be stressed too strongly as the greatest foremanship problem.

The value of foremanship training is in proportion to the extent to which the top management becomes interested and definitely co-operates. What value is there to the foreman in his improving his department unless his good work is to be recognized, unless there is a spirit which makes for progress throughout the entire organization? When there is a common agreement between management and foremen that they want to face these problems of management together, then we have the basis of instruction which will make the training increasingly valuable to and in the factory.

Promoting the Foreman

Taylor's intention and practice was to utilize the old-time foremen as a force from which to draw for the planning and control departments. In most of our shops, however, we have developed the planning and control departments from men picked from the cost or stores departments, or from the traffic or engineering staff, or by the introduction of recent college technical graduates into the work.

The result of this procedure has been that the foreman was almost totally excluded from participation in the designing, installing and operating of systems and procedures for planning and control. He became, consequently, either indifferent or hostile in his attitude. Instead of being an interpreter of management to the worker, he has become merely a gang boss.

It is becoming more generally realized by management that the biggest part of the duties of the foreman have to do with the human element in the factory. The foreman's big job today is much more concerned with human engineering than with either technique, mechanics or materials. He must know men, he must develop teamwork, and the modern foreman must study modern production methods because there is going to be small demand in any production organizations in the future for an executive who is not fully in sympathy with, as well as fully familiar with modern methods in factory organization and scientific methods in production and factory management.

The program for the developing of

foremen should include, after the production conference, the forming of a club of the company's foremen or "Pivot Men's Club," a community foremen's association, and national foremen's associations. The conferences on foremanship should be supplemented by home-study and correspondence work in foremanship. After completing a study of foremanship, the foremen shoud take up the study of industrial management for about a year, through industrial management conferences and through home study and correspondence work. This study should include a study of the methods and procedure of the company. The next year should be devoted to business management, economics, personnel management, or social problems. Foremen should be then sent as delegates to such organizations as manufacturers' associations, safety councils, local industrial relations associations, or the Society of Industrial Engineers.

Gatherings of a typical company "Pivot Men's Club" are usually of a semi-social nature and afford an opportunity for musical numbers by company quartets, orchestras and bands. The conferences if well conducted should stimulate individual thinking, advance collective thought, and result in the formation of well-defined conclusions on certain questions and the adoption of definite policies and actions on the part of the individual and the group as a whole. Group conferences are most successful when parliamentary practice is minimized. The program should be put in writing and suggestive questions assigned in advance. The group leader should be a man with personality and a capable chairman. He must not do much talking himself.

Organizing the Course

The better class of correspondence course is usually built up by having a recognized authority prepare an outline of the course. Competent specialists are called on to contribute assignments on topics in this outline. The material is then organized and edited from various standpoints before publication, from the standpoint of correctness and practicability; from the standpoint of pedagogic presentation; from the standpoint of presentation for the purpose of sustaining the interest and activity of the home-study student; and submission to a considerable number of men representing the field of employment, of the prospective students, with a view to getting their reactions and meeting any objections they may make as well as adding material indicated as a result of constructive suggestions.

Good Heads Required

When the courses are ready for service, the departments must be headed by men who have acquired recognized standing through wide experience in their subjects. The department head is frequently called upon by his students to give constructive advice. Here arises the real opportunity of the right kind of instructor and department head. A large percentage of correspondence students are more frank in their letters than they are when met face to face. The maximum amount of maturity, experience, understanding and sympathy is required to handle these cases.

Will foremen follow through a study course enthusiastically? The answer to this question, to quote from a report of the committee on foreman training of the National Personnel Association, is that much depends on the character of the course, the attitude of the management toward it, and the efficiency with which it is conducted. If the study material and exercises are stimulating and neatly adjusted to the foreman's interests and type of mind, he will usually find the work anything but a task. If, however, the course has been prepared in academic fashion, dealing in abstractions and heavy in style, it will not appeal to the average body of foremen.

The success of a study course depends on the quality and nature of the course, the attitude of the management and the skill with which the study group is handled. When a company prepares a course of this kind it does so with the object of making articulate to the foremen the details of its own policy on management. It does this on the assumption that a foreman, to be a success in a particular company, must be trained in the policies which are peculiar to that company and to its management.

The Design of Steam Hammer Anvils

By Eugene C. Clarke

Vice-President and General Manager, The Chambersburg Engineering Co.

THE greatest development in American drop forging practice has been in the use of multi-impression dies. Under a single hammer we will often rough out with "fillers" and "edgers," and perhaps have forming and finishing impressions in the die. The preponderance of off-center work, together with the demands for production, has been responsible for the developments in our drop hammers.

The steam hammer is the most powerful of the drop-forging hammers, since the falling weight of the ram is increased by the steam pressure on the piston. The anvil of a steam hammer must be designed to absorb the blow of its high-velocity ram, in order to get the maximum effect on the forging, and to keep excessive shock and vibration from the adjacent structures. The hammer foundation is also a shock absorber, and its construction affects the life of the anvil.

History of the Hammer

The first steam hammer was designed by Nasmyth in 1849. It was single acting, and most of the steam drop hammers that followed were in reality steam-lift gravity-drop hammers, distinct from the double-acting steam hammers of today. The first double-acting steam hammer is believed to have been designed in 1853 by Merrich and Towne.

The result accomplished in forming the forging in the dies depends on the plasticity of the metal, the velocity and mass of the ram, or falling weight, and the mass of the hammer anvil. It is customary to make the weight of a steam hammer anvil twenty times the falling weight without the dies. The increased falling weight due to the weight of the dies will reduce the effective work ratio, and any variation from the accepted practice should be to a higher ratio.

A steam hammer strikes with a velocity of approximately 35 ft. per sec. The most destructive condition of impact is when the forging is near the limit of deformation. To protect the face of the anvil, a hard steel cap, called a sow, is used. The cap serves to distribute the load on the anvil and is easily renewed when deformed by use. The force of the blow will be distributed through the cone-shaped part of the anvil extending out from under the cap, and it is essential that this part be solid and of sufficient depth. Cast steel anvils are the accepted practice.

Side thrust may be exerted by impressions that are off center, and ample thickness should be given to supporting frames. For example, if a ram 30-in. high strikes the work 10 in. off center approximately one-third of the force of the blow will be transmitted to the frames. The sections of the anvil that have to stay the frames against these shocks must be designed to meet the worst conditions of off-center work. Large seats for the frame are also essential in order to reduce rocking, and to minimize wear on the seat of the anvil.

A large percentage of the anvil failures appear as cracks at the base of the notch that forms the seat for the cap and its key. In practice the key is driven in with a suspended battering ram. If the key is driven in too tightly when the hammer is cold a tremendous pressure is set up when the cap and key become heated. Adding to this the shock of impact, the liability of failure is increased.

Stresses in the Anvil

Internal stresses in the anvil are largely governed by foundry practice and proper cooling conditions. There should be large fillets in the cores to permit a free flow of the molten metal. The positioning of the cores will also often effect the location of risers and pouring gates. The anvil is, of course, molded upside down, and is poured from both ends. Metal boxes around the cores, which may act as chills, should not be used.

The foundations under an anvil will influence greatly the life of the hammer, and of the surrounding buildings and equipment. The main object of the foundation is to absorb the force of the blows. It is imperative that a cushion be inserted between the anvil and the

concrete foundation. Oak timbers are favored for this purpose. If a further cushion is desired cork blocks are preferable to felt. It is better to use the timbers on their sides than on the ends. The anvil is held in position by large timbers around the base, reinforced by concrete. No foundation bolts are used as they are likely to break, and listing-lugs are also liable to be jarred off in a short time. This revised construction is considered highly efficient.

Standardizing Machinery Details

By Herbert K. Keever
McDonald Machine Co., Chicago, Ill.

STANDARDIZATION of unit assemblies may accomplish considerable towards building up a machine. But there is much work to be done before an assembly unit may be accepted as standard. The standardization of individual parts should be considered as a preliminary detail. All levers, links, pins, washers, set screws, piping, and other details of design should be analyzed, standard sizes should be chosen, and should be condensed to a practical working number.

Design and Manufacturing

After charts of all machine details have been prepared, a conference between the design and manufacturing departments should be held to discuss a correct working balance. The next procedure is to analyze the various types of machines being built to determine what standard assembly units may be designed that will be common to all. It may be possible in some cases to develop a standard speed mechanism, or driving unit. Clutch mechanism and many other units should also be analyzed to determine possible standardization.

In the case of a line of automatic punch presses, four standard strip-feed assemblies were made to handle a range of sizes and great variety of work on the machines. Press body units were also standardized, including the body, crankshaft, pitman, and slide. Standard charts showing the size and capacity of the units were prepared, and the auxiliary equipment necessary for special presses was also standardized and charted. When an order for a press is received, these charts form a basis for determining the proper units to be used for building the machine.

The advantages of standardizing design details of machinery are numerous. The time required in the designing department is reduced, and the detailing time on levers, links, and small parts, is entirely eliminated. In a number of cases it will be found that the only design work required will be to lay out and group a number of standard units into a mechanism.

Standard Unit Savings

Material savings are also accomplished throughout the plant in the course of construction of the machine. The cost of patterns will be a minimum, and the time of manufacture will be reduced. Standard units can be built in quantities and drawn from stock. Since the cost of a standard unit is easily obtained, the chief designer is usually able to present a good working idea of the cost when required to build a special machine. Many times, also, an explanation of the practical method of determining the cost to a prospective customer will go a long way towards "landing the order."

Plans for Management Week in October

Sponsored by five major engineering bodies and by the simplified practice division of the Department of Commerce, plans for the observance of Management Week are rapidly assuming concrete form. The date has definitely been set for Oct. 25 to 30. The subject of the meetings will be "Progress in Waste Elimination."

Following the plan adopted last year, the various engineering societies interested actively in this subject have arranged local and sectional meetings at which speakers will discuss various phases of management problems. The American Management Association, the American Society of Mechanical Engineers, the American Institute of Accountants, the Society of Industrial Engineers and the Taylor Society have each taken an active part in the preparation of this program. Chambers of Commerce throughout the country as well as civic bodies and trade associations have also given their approval and support to the purpose of the week.

The American Management Association will hold its annual meeting at the Hotel Statler, Cleveland, on Oct. 11, 12 and 13. The subjects slated for discussion are, trends in distribution, budgeting, management organization, personnel administration and office management.

Purchasing Agents to Meet in Chicago

The third district, affiliated with the National Association of Purchasing Agents, will convene in a three-day session, Oct. 14 to 16, inclusive, at the Congress Hotel, Chicago, Ill. The third district organization is composed of purchasing agents from St. Paul, Minneapolis, Milwaukee, St. Louis, Kansas City, Moline, Davenport, Rockford, and Chicago.

Machinery Prominent at Canadian Exhibition

A new high record for attendance at the Canadian National Exhibition during the two weeks it operates at Toronto was made this year, 1,573,000 people having passed through the gates from the opening on August 28 to the closing on Sept. 11. The former high record was 1,515,000 made in 1924. Last year's attendance was 1,491,300.

As in former years, there was an interesting display of machinery, machine tools and mechanical equipment in Machinery Hall. A notable feature was that manufacturers and dealers in machinery this year took considerably more interest in the arrangement of their exhibits, setting them up in such a manner as to give a more complete demonstration of capabilities.

Many new lines were prominent, and advancement in design and usefulness from a year ago was emphasized by many exhibitors. Study of the products on display gave a new and greater comprehension of the extent to which Canada is becoming industrialized.

Engineering Council Board Will Meet at Ithaca

The administrative board of the American Engineering Council will meet at Ithaca, N. Y., Nov. 11 and 12. Reports will be received from numerous committees which have been active during the summer. Among the topics in the large agenda which is being prepared are safety and production, registration of engineers, government reorganization, and jurisdictional strikes in the building industry. Dean Dexter S. Kimball of Cornell University, president of the council, will preside.

Fifth Power Exposition Set for December

Plans are already under way for the National Exposition of Power and Mechanical Engineering, which will have its fifth annual show at Grand Central Palace, New York, beginning on Dec. 6 and running through Dec. 11. At the same time the annual meeting of the American Society of Mechanical Engineers will be held in the Engineers' Bldg., and the annual meeting of the American Society of Refrigerating Engineers will be held in the Hotel Astor.

The exposition will include working exhibits of heat and power generating apparatus, hoisting and conveying equipment, power transportation equipment, machine tools, refrigerating machinery and heating and ventilating machinery.

There will also be educational exhibits of many mechanical inventions of the recent past, and motion pictures of important industrial developments.

Herberts Wins Prize

The Herberts Machinery and Supply Co., of Los Angeles, was awarded the grand prize for the best exhibit at the Industrial and Trade Exposition, held last month in the Civic Auditorium in Los Angeles.

The Herberts company occupied eight booths in which a great variety of machine tools was in operation under almost normal working conditions. High-speed ball bearing drilling machines, milling machines, turret lathes, shapers, threading machines, sawing machinery and several special types of tools were included in the exhibit.

News of the Week

Col. Horner Succeeds Cullen as President of N. B. P. Company

At a meeting of the board of directors of the Niles-Bement-Pond Co., held on Sept. 21, James K. Cullen submitted his resignation as president, in order to devote his entire time to his activities as president and general manager of the Niles Tool Works Co., Hamilton, Ohio.

The board regretfully accepted Mr. Cullen's resignation and elected as his successor Col. Leonard S. Horner, of New Haven, Conn. Colonel Horner had recently resigned as vice-president and manager of sales of the Acme Wire Co., of New Haven, of which company he continues as director.

Colonel Horner is a graduate in electrical engineering of Lehigh University, class of 1898. After his graduation he served with the American Telephone and Telegraph Co. as construction engineer and was later electrical engineer and sales manager for the Crocker-Wheeler Co. He is at present a director of the Crocker-Wheeler Company.

Colonel Horner has been very active in public work and is a great believer in trade associations. He is a director of the Pratt & Whitney Aircraft Co., of Hartford, vice-president of the New Haven Chamber of Commerce, a counsellor of the United States Chamber of Commerce, and a member of the Board of Aviation. During the World War he enlisted in the Signal Corps, Air Service Division, being commissioned Major and put in charge of the manufacturing facilities and production of Liberty engines, airplanes, airplane machine guns and other airplane accessories. He served in this capacity for eight months, when he was made a Lieutenant-Colonel and Chief of Staff to the Commanding Officer of Aircraft Production. His efforts in the production of Liberty motors and airplanes resulted in his being cited by the British Government for meritorious service.

Price Concessions Win Orders for Germany

The demand for American machine tools in the Czechoslovakian market continues slack, owing to the period of business stagnation through which that country is passing at the present time, according to advices to the Department of Commerce.

Manufacturers who have shown the most pronounced decline in their purchases of machine tools are those engaged in the production of sugar-mill machinery and agricultural implements.

In the case of the agricultural implement manufacturers, the domestic demand for their products was dull because of the low purchasing power of the agrarian population during the year as a result of the low internal prices for bread grains and cereals.

The automobile factories which are ordinarily heavy buyers of machine tools have not been in the market for such equipment during recent months, as in the latter part of the previous year they covered their requirements for new equipment.

Local dealers handling American machine tools anticipate a considerable improvement in the trade during the autumn months, basing their opinions on the possibility of an increase in the purchasing power of the agrarian population, and the probability of new equipment installations by the automobile manufacturers during their dull season.

Germany continues to be the strongest competitor of the United States in the sale of machine tools in the Czechoslovakian market. During recent months representatives of German manufacturers have taken many orders from agents handling American tools through their lower price quotations, particularly on cash transactions.

Industry in New York Prepared for War

"Industrial preparedness is insurance against war," states Col. James L. Walsh, chief of the New York ordnance district, in an interesting circular decribing the organization and activities of the New York ordnance office. According to Col. Walsh, the manufacturing industries of America are now paying three-fourths of the total taxes of the nation. At the rate of expenditure during the World War a million dollars an hour will be saved to the taxpayers for every hour that the duration of a war can be shortened by industrial preparedness.

The delay in getting under way during the late war was largely due to the fact that ordnance is not produced commercially in times of peace. One third of all the factory workers in the New York district had to be trained to new and unfamiliar tasks, and existing factory facilities had to be suddenly transformed for the manufacture of strange implements of war.

The peace time operations of the factories known as ordnance reserve plants, is the preparation of emergency production plans for the manufacture of such articles of ordnance as have been allocated to them by the district headquarters. In this way a considerable number of manufacturing plants will be prepared at short notice to turn to the production of ordnance in time of emergency.

Advisory Board Made Up of Prominent Men

The advisory board of the New York ordnance district is composed of civilians whose names are outstanding in the industries of the district. The chairman of the board is E. H. Gary, chairman of the United States Steel Corporation, and the other members are: P. E. Crowley, president, New York Central R.R.; J. M. Davis, president, Delaware, Lackawanna & Western R.R.; John I. Downey, president, John I. Downey & Co., Inc.; M. Friedsam, president, B. Altman & Co.; S. Parker Gilbert, Jr., agent-general of reparation of Germany; James G. Harbord, president, Radio Corporation of America; Herbert P. Howell, vice-president, Buhler & Co., Inc.; James H. McGraw, president, McGraw-Hill Publishing Co., Inc.; Samuel McRoberts, chairman, Chatham-Phoenix National Bank and Trust Co.; Dwight W. Morrow, of J. P. Morgan & Co.; Seward Prosser, chairman, Bankers Trust Co.; Charles M. Schwab, chairman, Bethlehem Steel Corporation; Guy E. Tripp, chairman, Westinghouse Electric and Manufacturing Co.; B. L. Winchell, chairman, Remington-Noiseless Typewriter Co.; William H. Woodin, president American Car and Foundry Co.; Owen D. Young, chairman, General Electric Co.

In addition to the prominent industrialists included on the advisory board, the New York District has many well-known engineers and executives among the reserve officers assigned to report to the district chief.

Army Tank on 1,150-Mile Trip

A light tank with its crew and accompanying transportation left Camp Meade, Md., on August 27th for a round trip to Welsh, West Virginia and return, a distance of 1,150 miles. The tank is being transported on a special Mack truck. It is accompanied by a 1,200-gal. Liberty gasoline tank truck. In active service these light tanks are to be transported to the scene of action on trucks because of the possibility of much higher speed. They will not operate under their own power until near the field of action.

Army Offers Courses in Ordnance Work

The War Department has announced a series of army correspondence courses which will be given during the year 1926-27. Many of these courses pertain to ordnance and machine shop work, and are open to civilians interested in national defense preparation.

The courses are free, and were originally designed for the training and instruction of officers and enlisted men in the Reserve Corps. The courses most likely to be interesting to men engaged in mechanical work are: Ordnance provisioning; ammunition depot organization; storage, surveillance and maintenance; transportation of explosives; shop administration; methods of machine shop work; and field maintenance. A course on army organization also deals in detail with the organization of the Ordnance Department. Other courses deal with small arms, artillery, tanks and tractors, and ammunition.

Full information regarding the courses of instruction can be obtained by writing to the commander of the Corps Area in which the applicant resides, or by writing directly to the War Department at Washington.

Study Hours and Wages in Steel Industry

The United States Department of Labor through the Bureau of Labor Statistics began a study of wages and hours of labor in the ten departments of the iron and steel industry in the United States early this year. While a survey of all establishments in the industry could not be undertaken, the statistics for each department may be accepted as fully representative, as they are based on a sufficient number of representative plants in each district to show conditions in their locality.

Summary figures for the different departments for 1926, together with like figures for earlier years, will be presented in the Labor Review as they become available. Tabulation of the data for the blast-furnace, open-hearth, and bar-mill departments has been completed.

The study shows that when the principal productive occupations are considered as a whole, there has been practically no change in the customary full-time hours per week of employees in either blast furnaces, open-hearth furnaces, or bar-mills since the unprecedented reduction in working time as shown by the figures for 1924. Prior to 1924 the blast-furnace and open-hearth-furnace departments were largely on a 12-hour day basis and bar-mills usually operated two turns per day of from 9 to 12 hours each. The figures for 1924, however, show that the 8-hour day had been adopted at that time to a large extent by the plants in all three departments, only a few of them still retaining the 12-hour day.

Earnings per hour remained almost stationary during the period 1924 to 1926 in blast furnaces but increased practically 10 per cent in open-hearth furnaces and three per cent in bar-mills. The increase in open-hearth furnaces raised the earnings per hour to a point higher than any recorded by the bureau in any of its studies.

By comparing the 1926 figures with those for 1924, however, it was found that the increase was due largely to an increase in production and not to any radical changes in basic rates of pay. Practically all employees in open-hearth furnace establishments are paid on a tonnage basis, their earnings depending directly upon the amount of metal produced. The increase in the average earnings per hour in bar-mills was also largely due to increased production.

Those employed in the principal productive occupations in blast furnaces in 1926 earned over two-and-one-half times as much per hour as those employed in 1913.

Truck and Coach Operation on S.A.E. Program

Problems in motor truck and motor coach operation and maintenance are to be discussed in forenoon and afternoon sessions of a three-day national automotive transportation and service meeting to be held in Boston on Nov. 16, 17 and 18, by the Society of Automotive Engineers.

Addresses are to be made by recognized experts on the subjects of the co-ordination of motor coach systems and railroads, the operation and maintenance of motor truck and motor coach fleets, freight handling and store-door delivery by automotive equipment, handling of goods in interchangeable containers, cost of operating gasoline-electric vehicles, brake requirements of trucks and coaches, maintenance tools, and the relation of design to the power characteristics of the engine.

On the second day an inspection trip of great interest will be made to the maintenance plant of a local company that operates a great number of motor trucks.

Members of all societies and associations that are interested in the subjects to be discussed are to be invited to attend the technical sessions and a banquet to be held on one of the evenings.

Automobiles in Argentina

The market for automotive products in Argentina during the second quarter of this year slowed down considerably, due in part to the usual seasonal decline expected at this time, but more particularly to the actual general depression in the economic conditions of the country, states a report to the Department of Commerce.

Machinery Imports in Canada Increase

Canadian Government trade reports for the twelve months ended July, 1926, show a considerable increase in imports of machinery and machine tools when compared with the previous twelve months. During the period under review the combined imports of machinery and tools totalled in value $37,284,638, being an increase of $8,687,659 over the twelve months ended July, 1925. In imports of rolling mill products there was an increase of $10,000,000, while imports of farm implements were greater by $9,400,000. Other interesting comparisons in the imports under the heading of metals are as follows:

	Twelve Months Ended July	
	1925	1926
Electric apparatus	$13,564,428	$16,599,444
Tubes and pipe fittings	2,609,755	3,834,479
Wire	2,617,488	3,050,971
Engines and boilers	9,324,166	13,059,921
Hardware and cutlery	3,148,591	3,626,996
Freight automobiles	1,579,943	2,213,708
Passenger automobiles	11,205,269	20,129,438
Automobile parts	16,108,720	25,548,603

A.E.S.C. Year Book Shows Progress

The movement toward standardization of industrial products has been considerably extended during the past year; and savings from standardization work are constantly growing in magniture, according to the Year Book of the American Engineering Standards Committee, just issued. More than 200 definite standardization projects are in process or completed under the auspices of the 365 national trade associations, technical societies and government bureaus are co-operating in the work through some 1,600 representatives.

The general adoption of a comprehensive system of limit gaging developed by a representative committee of experts and approved during the past year, can, it is estimated, produce savings for American industry approaching a billion dollars a year.

Progress has been made on some fifty safety codes applicable to factories; and codes for paper and pulp mills, elevators and escalators, and for manufactured gas, were completed and approved during the year.

For the convenience of American industry, the A.E.S.C. is maintaining a file of specifications to be sold at cost. These include standards issued by all of the foreign standardizing bodies with which it regularly exchanges information and standards, and also those of trade associations and societies in the United States.

The A.E.S.C. maintains an extensive file of specifications that are constantly referred to by engineers and experts in every field. About 7,000 standards are available for examination and reference in this way. This information service is frequently of value to exporters, who have the problem of supplying goods to a distant purchaser in accordance with standards of material or dimension originating in a foreign country.

The membership of the A.E.S.C. now consists of 19 national trade associations, 9 national technical societies, and 7 government departments. Charles E. Skinner, assistant director of engineering of the Westinghouse Electric and Manufacturing Co., is chairman of the committee, and Charles Rufus Harte, construction engineer of the Connecticut Company, is vice-chairman.

Copies of the Year Book may be had upon application to the office of the American Engineering Standards Committee, 29 West 39th Street, New York.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
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IN CONSIDERING the week's developments sympathy and self-interest both lead us to give first place to the loss of life and property in Florida. The former is deplorable and the nation grieves with those who are bereaved but the property destroyed can be replaced or reconstructed and it may be that its loss is a blessing in disguise.

This may seem to be a hard saying to those whose buildings have been blown down or washed away but the American cities that have been overtaken by great disasters in the past have generally emerged stronger and better than they were previously. Therefore it is quite possible that the post-fire history of Chicago, San Francisco, Baltimore and Boston may be repeated in Florida. The reasonableness of this suggestion will be apparent when we consider that any great disaster is somewhat like a war in that it means the destruction of property that must ultimately be replaced.

The result is increased activity and a renewal of hope. These are the material and spiritual essentials of prosperity and as we all know that the Floridians will not permit Florida to be permanently desolate, it is quite possible that the money which will now be put into reconstruction there may partially revive the land boom that was slowly dying until the storm came to avert its demise.

At all events it seems unwise to count too heavily upon the Florida hurricane as a depressing factor for we may again be brought to realize that "it is a very ill wind that blows no good."

Meantime all that can be said is that the tropical storm has not appreciably affected business that was not directly in its path. Distributive trade is fully up to last year, but recent bank clearings and car loadings are not in excess of the record for 1925. A severe decline in cotton followed the issuance of a government report which estimated the crop at 15,810,000 bales. No one knows whether the figures are right or wrong, but they have unsettled the trade and worked a severe impairment of the South's purchasing power. Therefore they are to be regarded as an adverse factor and as they have made every one afraid to buy cotton, there is no speculation for the advance.

The same thing is true of the grain market. The government's surveillance has driven speculators away from it and it is in the doldrums with a downward tendency whenever there is any activity.

Coffee is also paralyzed by the action of the Sao Paulo government in rationing the Brazilian supply, and rubber and sugar are about the only commodities left in which one can speculate without running up against official restrictions that limit trading.

It is true that the Cuban government has issued a decree which interdicts the cutting of sugar cane before the first of January next and that the production of rubber is still subject to the provisions of the Stevenson plan, but in neither sugar nor rubber has there been any attempt to limit trading and free markets for both are still maintained.

Incidentally they are both higher, but the advance in sugar is due to a belated appreciation of a prospective scarcity while rubber has improved because a further restriction of exports from the British plantations is expected.

Iron, steel, copper are all rather easier to buy. A continued contraction in building operations is probably responsible for the reduction in the demand for metals that are chiefly used in new construction, but the railroads are now so well equipped that they are buying but moderately and the automobile manufacturers comprise about the only group whose orders are as large as last year.

Generalizing it is probably accurate to say that there is some reduction in the business that reflects the investment of capital in new projects, although the demand for food and clothing is as large or larger than it was last year.

As a generalization it is also true that most experienced observers expect and are prepared for a reaction in trade and that when it comes it will not be keenly felt because it has been anticipated.

The stock market appears to reflect the latter view for it has been firm in the face of happenings that would have caused a severe break if there had been any radical weakness in fundamental conditions.

But this is not to say that prices will continue to advance or that it will be unwise to take profits. Money is slowly hardening. Brokers' loans are rapidly increasing. Some railroad stocks are being almost recklessly bought upon the theory that the Van Sweringen consolidation will soon be consummated and that its completion will be attended by a blaze of speculative glory. This may all be true but it is an old saying that "the last monkey is always drowned," and with the stock market at the highest level ever touched for many securities, it is common sense to take profits and put them on ice.

Many things that would cause a change in sentiment may happen. It is not necessary to recount them. They are always among the possibilities. But at the present altitude they would be more keenly felt than at a lower level and when everything looks lovely and the goose hangs high, it is well to be on guard.

What's Doing in Industry

Business in machinery and machine tools took on a rather uncertain air in the past week. Sales that were awaiting only official sanction to close have been held up indefinitely. Inquiries have also fallen off. Many believe this a temporary lull brought on by the Chicago exposition, which offered prospective buyers an excellent opportunity to see machines in operation before confirming orders. The show is expected to prove a real stimulant to business in the immediate future.

Reports from various industrial centers show a spotty condition. New England plants are busy and the present volume of orders and inquiries encourages optimism. The New York market is quiet, orders and inquiries falling off considerably. Buffalo reports slight signs of improvement, but expected activity has failed to appear. In Philadelphia business is improving, with industrial machinery leading a brisk demand.

The Mid-West is fairly active. Detroit experienced a slight improvement in the past week, sales to automobile and accessory manufacturers increasing. The show in Chicago occupied the attention of buyers and sellers in that city last week, and the results are not yet apparent. Cincinnati reports further improvements with orders and inquiries satisfactory. Moderate activity continues in Milwaukee, automotive and railroad needs promising good business for the remainder of the year.

Most experienced observers expect and are prepared for a reaction in trade throughout the country. But when it comes it should not be keenly felt because it has been anticipated.

The Industrial Review

Progress of the machinery and machine tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Chicago

Offices and salesrooms of machinery dealers and manufacturers having representatives in this city are largely deserted this week except in the mornings and evenings. Not only executives, but the local, and several of the traveling sales forces are giving practically all their time and attention to the exposition being held at the Municipal Pier under the auspices of the American Society for Steel Treating.

From several sources it is learned that a gratifying number of orders are being booked at the exposition for immediate and future delivery, and it is predicted that a big selling impetus will follow as a result of the demonstrations being made. Dealers in used machinery are somewhat dubious as to any good effect the exposition will have in their sales, some of them going so far as to say that there will be a reaction among buyers in favor of new, as compared with used tools.

Manufacturers of band and back saws report a better business this month than for a year past. Trade in grinding machinery and abrasives continues on a high level. Railroad buying is negligible, as is that of the big specialized industries. The list issued by the Illinois Steel Co. has not yet been closed.

New England

Operating schedules of plants in the principal machinery centers of the New England territory are being extended in a few instances, and generally speaking the working forces throughout the territory are being increased. Orders are booked well in advance and continue to flow in satisfactorily. These conditions, together with prospective business appearing, encourage the optimism now prevailing.

Domestic business is described in such terms as "very good" and "excellent," and satisfactory foreign orders are being received. Production machinery is in excellent demand.

Based on man-hours the machinery industry in Hartford, Bridgeport and New Britain is from 10 to 15 per cent better than at the corresponding time a year ago.

Detroit

Little change has been noted during the past week in the market conditions for machinery and machine tools in the Detroit district. If anything, there has been a slight increase in the volume of sales and in the number of inquiries. Orders are widespread through the automobile factories, accessory plants and general manufacturing establishments.

Most orders have been for single tools, although in some cases more than one machine has been ordered.

New machines have been ordered by Packard, Paige and Hudson, while the purchase of new equipment by Cadillac and Dodge is moving forward. Many of the Michigan automobile plants are planning important announcements around automobile show time, and many departments are being thoroughly overhauled and modern equipment purchased.

The market for used tools is good, with most of the standard machines in the hands of used machinery dealers being taken immediately. Small shops have proved the largest buyers of this type of equipment.

Railroads are buying in small quantities. The Michigan Central is putting out monthly lists now, and while none of the lists are large in themselves they constitute a considerable amount in the year's total.

Philadelphia

Conditions in the machinery and machine tool line in Philadelphia during the last fortnight were such as to indicate that forecasts of the early resumption of substantial buying were justified. Inquiries received from a well distributed area over the country were reported by tool producers as having come from such sources that orders of a substantial nature are anticipated.

Mid-Western industries have been purchasers of stokers from Philadelphia producers, orders having come from as far as Chicago and Detroit and the territory surrounding those cities. The sales were to industries covering a wide range of activity. Manufacturers of hoisting machinery report an active season, but the last two weeks has shown a falling off. The same is true of belting machinery. Plants generally have been operating up to 75 per cent of their capacity.

Gear manufacturers report a satisfactory business, with plants operating from 60 to 75 per cent of capacity. Producers of gear-cutting machinery reported a falling off in orders, one plant operating at about 25 per cent. This plant is devoting a portion of its equipment to experimental work.

New York

There has been a slight falling off in machinery sales in this city and vicinity. The reason is not apparent, though many believe the holding up of certain orders is due to the fact that prospective buyers have postponed confirmation until they have inspected the machines in operation at the Chicago exposition.

The inquiry mail has been irregular and no large lists are reported. Action is still pending on the forty or more tools on the B.M.T. list.

The second-hand market is active, several fair-sized orders being reported in the past week. Cranes, hoists and miscellaneous yard equipment have been in demand. Railroads have done little or no buying hereabouts in the past two weeks, although the New York Central bought a planer, a lathe and a vertical drill press.

The Hughes Tool Co. bought two 16-in. geared-head lathes; the American Can Co., a jig borer; the Scintilla Magneto Co., 2 automatic milling machines; the Lufkin Rule Co., 2 lathes; the Detroit Street Ry., a car-wheel lathe; and the Westinghouse company, a large boring mill.

Milwaukee

The state of trade in metal-working equipment continues moderately active, and by comparison with a year ago, it is fully equivalent in volume of new orders coming forth. Already favorable results are growing out of the steel and machine tool exposition at Chicago. It develops that a relatively large number of prospects for new equipment awaited the assembling of the latest types of tools for convenient inspection before placing orders.

The automobile trade is probably the best customer as a group, although current demand comes mainly from the larger organizations. Manufacturers of parts, equipment and accessories, who comprise a most formidable part of the local metal-working industry, are making additions to equipment steadily. The outstanding expansion in this direction locally, that of the A. O. Smith Corporation, is still requiring considerable equipment, although the main needs have been placed in the past two to three months to insure delivery in ample time.

No important activity is noticeable among railroads as yet, but there appear to be heavy needs in the foreground which cannot much longer be postponed.

Cincinnati

Machine tool manufacturers in the Cincinnati district report a further improvement in demand in the past week. While the buying of no one industry reached proportions that are large enough to be regarded as an outstanding feature, the aggregate sales have increased in a way that gives encouragement and is regarded as satisfactory.

Manufacturers who have given the matter much thought express the opinion that the demand has by no means reached its peak, predicting that the machine tool market will continue to become livelier for several weeks to come. Heads of selling agencies take the same view.

Orders booked in the week came from various classes that use machine tools. The greater part of these continued to be for single tools and replacements. Inquiries came in freely from all sections of the country and from all classes of users.

The largest buying done in the week was by concerns in the automotive industries, some calling for several tools but the majority calling for single tools and replacements. In a few instances orders from railroads called for several tools, but the majority of the requisitions from this source called for single tools. A few export orders were received and some increase in the foreign demand is expected.

Buffalo

While there have been some slight and sporadic signs of improvement in the machine tool and equipment trade here since Labor Day, the anticipated upturn in business has not materialized. It was generally believed that a brisk business would be encountered shortly after Labor Day but this has not been the case.

Inquiries are little better than was the case in August, and some of the business closed by the two or three dealers who reported a good business for the first half of September was the result of negotiations started some months ago; in a few cases as far back as the first month of the year.

The demand for contractors' and road builders' equipment is quite definitely off, but this is a seasonable condition and is not looked upon with any special interest. The construction of two large cement plants in the Buffalo area has created some electrical equipment business but most of this fell to one dealer.

Bureau Perfects Methods of Testing Weights

Short methods of testing sensitive weights used by scientific and technical laboratory workers are described in a recent scientific paper of the Bureau of Standards.

Two of these methods show how to calculate the values of all the weights of a set from a single large standard weight, thus avoiding the great expense of a full set of standards. To keep the work as simple as possible there should also be two or three small weights, the accuracy of which is known. Even without any standards it is generally possible to find accurate values of the small weights, and accurate "relative" values of all of the weights of the set.

Copies of the paper describing this work are now on sale at the office of the Superintendent of Documents, Government Printing Office, at 10 cents each.

Ordnance Adopts X-Ray to Detect Flaws in Gun Castings

Use of the X-ray machine to detect possible flaws in steel or castings for big guns, has just ben announced by enginers of the Ordnance Department, United States Army. Possibilities of applying the use of the X-ray to the problems of commercial industry, were cited by the enginers.

The Ordnance Bureau is utilizing the X-ray in research laboratories at the Watertown Arsenal, where, it is said, defects in the metal can be determined. A radiograph is made of the metals entering into the structure of the gun and flaws undetected by the naked eye are clearly indicated.

There is a similarity between the X-ray apparatus used in large hospitals and that recently installed in the Watertown Arsenal. The equipment in both instances conforms to the type designed by W. D. Coolidge, of the General Electric Co. In the government experimental gun factory, the installation consists of a 280,000-volt X-ray machine, which includes improved vacuum tubes and other modern accessories.

The penetrating effect of Roentgen rays is apparent when we are told by officials that valuable practical results have been obtained in revealing the structural characteristics of metals as much as 2½ in. thick.

This new application of an old instrument of science offers potential uses in commercial industries.

Advise Prospecting for Sillimanite Here

Government experiments, which have been in progress for some time, are demonstrating that sillimanite is a very superior refractory. It withstands very high temperatures successfully, is strong, practically non-fusible and has a low co-efficient of expansion. It is suitable for uses where mechanical requirements and heat variations are severe.

The use of this material started in spark plug manufacture, but now extends into many fields, particularly to electric and other metallurgical furnaces.

India is the source of all sillimanite now being used. There are large deposits in that country. As the material is a silicate of aluminum it is regarded as highly probable that it occurs in this country. In view of the fact that increased use of this refractory is assured, mining engineers in the government service think prospecting in this country for the material would be advisable.

Master Quartz Flat Made by Scientists

A surface which is within one-ten-millionth of an inch of being perfectly flat—an accomplishment which scientists admit is most difficult—has been made by the Bureau of Standards out of quartz, and, it is predicted, will make for more accuracy in the development of intricate mechanical instruments employed in virtually all machinery.

This "master quartz flat," as it is referred to by scientists, will supplant the glass flats previously used by the bureau in testing micrometers and other measuring gauges used by manufacturers. The glass flats, it was explained by G. E. Merritt, scientist of the Bureau of Standards, could not attain the degree of accuracy which now is made possible through the advent of the quartz instrument, because of its tendency to expand by heat.

The procedure of testing micrometers used in industry involves a series of tests, the bureau explained, all founded on the "master quartz flat," whose precise accuracy is essential in order that the other stages of the rigid test likewise may be accurate.

What the Railroads Are Doing

The Soo Line is inquiring for 10 mountain type locomotives.

The New York Central has asked for quotations on 40 coaches, 30 suburban cars, 5 combination passenger and baggage cars and 4 suburban combination passenger and baggage cars.

The Kentucky & Indiana Railway has ordered 6 switching locomotives from the Lima Locomotive Co.

The Central Railroad of New Jersey has asked the Interstate Commerce Commission for authority to assume liability for $2,670,000 to be applied to the purchase of new equipment, including 25 steel passenger coaches, 5 steel baggage-express cars, 5 combination passenger and baggage cars, 100 seventy-ton gondola cars, 200 steel automobile cars, and 800 steel box cars.

The American Locomotive Co., has received orders for thirty locomotives in lots of ten each, for the New York Central, the Minneapolis, St. Paul & Sault Ste. Marie, and the Norfolk & Western Railroads.

An order for 533 steel underframes has been placed with the Pressed Steel Car Co., by the Fruit Growers Express.

The Seattle Municipal Street Railways Co. has booked eighty steel cars with the St. Louis Car Co.

The American Car and Foundry Co. received a contract for eleven underframes from the East Jersey Railroad and Terminal Co.

The Baldwin Locomotive Works booked one switching engine from the St. Paul Bridge and Terminal Railway Co.

New inquiries include 500 steel mine cars for the Consolidation Coal Co. and fifty box cars for the New Orleans Public Belt Railroad.

Bids have been submitted on 2,000 refrigerator cars for the American Refrigerator Transit Co.

News of the Automotive Industry

The United States exported 17,077 passenger cars, valued at $12,005,835, and 5,409 trucks and buses, valued at $3,859,001 in July of this year, as compared with 15,354 passenger cars, valued at $11,816,491, and 4,580 trucks and busses valued at $3,393,191 during the preceding month, according to the Automotive Division of the Department of Commerce. The July exports also were of greater volume than the similar foreign shipments in July of last year, when 16,567 passenger cars and 4,294 trucks and busses were sent abroad from this country.

From present trends in the automotive trade in South Africa, it is believed in that country that the prospects for that trade during the remainder of the current year are favorable. It is estimated in South Africa that automobile imports during the first quarter of this year totaled 5,900 cars and that the receipts during the second quarter amounted to 5,700 cars. Sales reported during those periods were 6,200 cars and 6,500 cars respectively.

Some revival in the German automotive trade was noticeable during the first half of 1926, according to advices to the Department of Commerce. The chief obstacles in the way of automobiles dealers and importers are said to be the lack of available cash with the purchasing public and the difficulty of finding buyers to whom credits for installment payments, can be extended with safety.

With a view to learning of Canadian needs in motor vehicles and to review motor activities in the States, Alfred Reeves general manager of the National Automobile Chamber of Commerce, will make a tour of Canada beginning on Sept. 20. He will speak at meetings in Hamilton, Toronto, Oshawa, Ottawa, Montreal and Quebec. W. G. Robertson, secretary-treasurer of the Automotive Industries of Canada, is also managing the trip, which has for its purpose a better understanding of marketing and use of cars, trucks, buses, and cabs. Particular attention will be given to methods of sales, service and financing by dealers. The meetings will also consider taxation, traffic, and other factors in the use of motor vehicles by the public.

Europe's growing interest in motor travel is being emphasized by the cordial receptions which are being given to George F. Bauer, secretary of the foreign trade committee of the National Automobile Chamber of Commerce, who is spending several months on the Continent, on the invitation of motor groups abroad. Swedish motor leaders have been particularly active in arranging opportunities for Mr. Bauer to meet with the automotive groups in that country. He has spoken before the Royal Automobile Club and the Stockholm Dealers Association. American manufacturers recognize that each country has its own business methods, and Mr. Bauer on his trip is making a special study of foreign merchandising procedure. His hosts, on the other hand, have been seeking information on automobile financing, traffic control and legislation as developed in this country.

Personals

J. B. MacNeill has been appointed manager of the newly created circuit-breaker engineering department of the Westinghouse Electric and Manufacturing Co.

R. J. Younge has resigned as general sales manager of the Canadian Car and Foundry Co., Montreal. It is understood Mr. Younge intends entering business for himself.

P. A. FRANSSON has been appointed chief engineer for the Agnew Electric Welder Co., of Milford, Mich. He was formerly engineer for the Winfield Electric Welding Machine Co.

GEORGE ROBERTS, JR., manager of the Thistle Wire Works at East Lee, Mass., has acquired the property from the estate of his father, former proprietor, for approximately $75,000.

G. A. WHITE, metallurgical research engineer for the Otis Steel Co., has resigned.

L. A. WAY has been elected president and general manager of the Sharon Foundry Co., Sharon, Pa.

CARL G. SCHLUEDERBERG has been appointed general manager of the George Cutter Co., of South Bend, Ind., a subsidiary of the Westinghouse Electric and Manufacturing Co.

O. H. SCHAFFER, for several years gear expert with the Studebaker Corporation, is now representing the timing gear interests of the Diamond State Fibre Co., in Illinois, Indiana and Wisconsin.

W. H. EISENMAN, secretary of the American Society for Steel Treating has been granted six weeks leave by the directors of the society for a visit to Europe. Mr. Eisenman will sail probably in October.

J. K. B. HARE, formerly in charge of public utility sales at Pittsburgh for the Westinghouse Electric and Manufacturing Co., has been appointed manager of the new branch office of the company at Columbus, Ohio.

WILLIAM CARMAN, JR., of Summit, N. J., and PERCY HEDGES, JR., of Cambridge, Mass., have been appointed to the staff of the textile division of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

G. H. FELTES, from 1905 to 1925 with the U. S. Electrical Tool Co., Cincinnati, Ohio, part of the time in the capacity of secretary and treasurer, is now president and treasurer of the Standard Electrical Tool Co., of Cincinnati.

DUBOIS YOUNG, vice-president and head of the manufacturing division of the Hupp Motor Car Corporation, has been elected president and general manager to succeed Charles D. Hastings who has become chairman of the board of directors.

CAPTAIN E. V. RICKENBACKER has resigned as vice-president of the Rickenbacker Motor Co., according to an announcement made by himself last week. For the present Capt. Rickenbacker intends to confine himself to his numerous aviation interests. He will not relinquish his holdings in the motor company.

F. H. ANDERSON has been promoted from engineering superintendent to sales manager of the Gotfredson Truck Corporation. Mr. Anderson has been with the corporation for three years. He was previously general superintendent of the Fairbanks-Morse Co., and has been connected with the Packard Motor Car Co., and the Crane-Simplex Co.

W. PEASLEE, shop superintendent of the Cincinnati Milling Machine Co., who, it was recently announced in the *American Machinist*, is to be a director of the newly-formed Cincinnati Grinders, Inc., is also to be works manager of the same company. Mr. Peaslee's successor at the Cincinnati Milling Machine Co. has not been announced.

R. E. PRUSSING, for several years sales manager in Detroit for the Whiting Corporation, of Harvey, Ill., has been transferred to the main office. He has been succeeded in Detroit by W. R. Hans who had been district manager at Buffalo. C. G. Crewson and A. E. Smith, of the Industrial Equipment Co., will handle the Buffalo sales territory.

WALTER H. JONES has been appointed chief engineer of the Auto Body Co. of Lansing Mich. In 1919 he held the position of experimental engineer with the C. R. Wilson Body Co. Later he was chief inspector of all plants and in 1921 was promoted to chief engineer. In 1924 he resigned his position to become chief engineer with the Gotfredson Corporation.

THOMAS S. MERRILL, secretary of the General Motors Corporation, has been re-elected president of the Detroit Board of Commerce. He was unanimously chosen to head the board for the year 1926-27. W. C. Cowling, director of traffic of the Ford Motor Co., has been re-elected a director of the Board of Commerce. S. Wells, Utley, vice-president of the Detroit Steel Casting Co. has also been re-elected to the Board.

Obituaries

HENRY F. BLANCHARD, formerly treasurer of the Metal Saw and Machine Co., Inc., of Springfield, Mass., and for the past two years assistant to the president of the American Can Co., of New York, died in his home in Springfield, on Sept. 10.

HOWARD WARD LESTER, pioneer auto accessories manufacturer, died on Sept. 14 at Hartford, Conn. Mr. Lester was one of the founders of the Post & Lester Co., Hartford, Conn. He was general manager and treasurer of this company at the time of his death. He was secretary of the Veeder Manufacturing Co., Hartford; and president of the Hall-Thompson Co.

FRANCIS LANSON ADAMS, president of the Adams Fence and Wire Co., of Hartford, Conn., died recently at his home in Westport, following an illness of two months. Mr. Adams was a graduate of the Sheffield Scientific School, Yale University. He was for a time superintendent of the Jones & Laughlin Steel Works, Pittsburg, Pa., and later was connected with the Page Steel & Wire Co., Bridgeport. He organized the Adams Fence & Wire Co. in 1923.

GEORGE G. F. BOSWELL, of Indianapolis, said to have been the inventor of the first self-starter of automobiles, died recently at the age of 65. He had received more than 400 patents on devices he had perfected for automobiles, farm implements and other types of machinery. Mr. Boswell was prominent in mechanical and engineering circles in Indianapolis. His death came after an illness of several months. He is survived by his widow, three sons, and a daughter.

Business Items

New Departure Manufacturing Co., of Bristol, Conn., a General Motors subsidiary, has purchased a tract of five acres of land having railroad frontage, with a view to future plant expansion.

The Motor Meter Co. has acquired the National Gauge and Equipment Co. of La Crosse, Wis., manufacturers of oil gases and meters and other car equipment in conjunction with the Boyce Moto Meter Co.

Charles H. Abbott, Inc., Hartford, Conn., has incorporated to manufacture steel ball bearings, burnishing implements and metallic burnishing materials. The incorporators are: Chas. H. Abbott, Albert C. Bill and Albert S. Bill.

Juan Pujol, manufacturer of special machinery, announces his occupancy of a new factory and offices at Calle Nuestre Senora de los Angeles & Quiroga, Luyano, Havana, Cuba. The new building, of three stories, is equipped with all modern machinery and facilities for the conduct of a first-class service and manufacturing business.

The Link-Belt Co., 910 South Michigan Ave., Chicago, Ill., has opened a branch office at 107 Foster Building, 131 Genesee St., Utica, N. Y. This office is to be devoted especially to the sale of Link-Belt silent and roller chains, and will be in charge of F. P. Hermann, Jr., who was previously with the New York office.

Announcement is made of the organization of the Koebel Diamond Co., Inc., of New York City, by Frank E. Koebel and Charles J. Koebel. The above named purchased the interests of George A. Joyce, of London, in the former Joyce-Koebel Diamond Co., and will continue the business under the firm name of Koebel Diamond Co., Inc.

The Roller-Smith Co., 233 Broadway, New York, N. Y., announces the appointment of hte following new agents: The Robinson Sales Co., Polson Bldg., Seattle, Washington for the State of Washington and most of the State of Oregon; The Ashida Engineering Co., Ltd., Daini, Osaka, Papan for Japan (including Korea and Manchuria). Through the latter connection the Roller-Smith Co. expects a large increase in its Japanese business.

Pursuant to a decree from the United States District Court, E. S. French, receiver for the Vermont Farm Machine Corp. of Bellows Falls, Vt., has advertised the entire property, real and personal, for sale at auction on the premises, Oct. 16. This concern, which was established in 1868 and had a prosperous career for many years, went into a receivership about five years ago. Receivers' certificates have been issued to the amount of $400,000.

The Milwaukee Press and Machine Co., 339 First Ave., Milwaukee, has acquired the entire business and property of the Lutter & Gies Co., manufacturer of machinery, tools, etc., and is consolidating the works in the Lutter-Gies plant at 258-261 Lake St. in order to effect a required measure of manufacturing area. The Lutter & Gies Co. was established in 1889 by Herman Lutter and Ernst A. Gies. The Milwaukee Press and Machine Co. is of more recent origin. Anson Eldred is president.

The Kinite Corporation, Milwaukee, Wis., has increased its sales force. Kenneth L. Clark, formerly of the steel division of Henry D. Disston and Sons, Philadelphia, Pa., will represent the corporation in Michigan, Illinois, Indiana, Iowa and a part of Missouri. The Detroit office of the corporation, in the General Motors Building, will be in charge of R. H. Herbst, formerly of the Milwaukee office. P. L. Getzinger, with offices at 709 First National Bank Building, Chicago, will represent the company in Illinois and Indiana.

Forthcoming Meetings

National Association of Manufacturers. Thirty-second annual meeting, Waldorf-Astoria Hotel, New York, Oct. 5, 6 and 7. George S. Boudinot, secretary, 50 Church St., New York.

American Institute of Mining and Metallurgical Engineers. General meeting, Hotel Schenley, Pittsburgh, Oct. 5 to 9. H. F. Bain, secretary, 29 West 39th St., New York City.

American Management Association. Fall meeting, Hotel Statler, Cleveland, Oct. 11 and 12. W. J. Donald, managing director, 20 Vesey St., New York City.

American Gear Manufacturers Association. Semi-annual meeting, Briarcliff Lodge, Briarcliff Manor, N. Y., Oct. 14, 15 and 16. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Iron and Steel Institute. Fall meeting, Hotel Commodore New York, Oct. 22. E. A. S. Clarke, secretary, 40 Rector St., New York City.

Management Week. National observance, Oct. 25 to 30. General theme—"Progress in Waste Elimination." Organizations cooperating are the American Society of Mechanical Engineers, American Management Association, American Institute of Accountants, Society of Industrial Engineers and the Taylor Society.

National Safety Council. Fifteenth annual safety congress, Detroit, Mich., Oct. 25 to 29. A. A. Mowbray, director, 108 East Ohio St., Chicago.

American Welding Society. Eighth annual fall meeting, in conjunction with International Welding and Cutting Exposition, Broadway Auditorium, Buffalo, N. Y., Nov. 16 to 19. Secretary's headquarters, 29 West 39th St., New York City.

National Exposition of Power and Mechanical Engineering. Fifth event, Grand Central Palace, New York City, Dec. 6 to 11. I. E. Moultrop, chairman advisory committee, Edison Electric Illuminating Co., Boston, Mass.

The Weekly Price Guide

Rise and Fall of the Market

THE pig-iron market at the present time does not show the evenness prevalent in steel. Iron buying is active in the Philadelphia district; prices are firm, with inquiries better at Birmingham; the situation in New York, however, reveals dullness. Steel sheet quotations, in some of the mills in the Pittsburgh district, range $2 per ton above last week's prices; schedules are mainly at the Sept. 23 levels, with corrections for the new 24 Gauge base and differentials, on black and galvanized stock. Firmness with upward tendencies are noted in steel plates and tin plates. Steel sheets and plates have both evidently emerged from the recent period of dullness which affected these markets. The principal hot-rolled steel products hold at the $2 level for bars and shapes and $1.90 per 100 lb., f.o.b. Pittsburgh, on plates.

(All prices as of Sept. 24)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.19
Northern Basic	20.39
Southern Ohio No. 2	21.39
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	27.37
BIRMINGHAM	
No. 2 Foundry	21.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.76
Virginia No. 2	28.67
Basic	21.26
CHICAGO	
No. 2 Foundry local	21.75
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.05
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	19.76
Basic	19.76
Bessemer	19.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00@5.50
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.30	3.50	3.15	3.89
No. 12	2.35	3.55	3.20	3.94
No. 14	2.40	3.60	3.25	3.99
No. 16	2.50	3.70	3.35	4.09
Black				
Nos. 18 to 20	2.80	3.75	3.50	4.15
No. 22	2.95	3.90	3.65	4.30
No. 24	3.00	3.95	3.70	4.35
No. 26	3.10	4.05	3.80	4.45
No. 28	3.25	4.20	3.95	4.60
Galvanized				
No. 10	3.15	4.10	3.85	4.40
Nos. 12 to 14	3.25	4.20	3.95	4.50
No. 16	3.35	4.30	4.05	4.60
No. 18	3.50	4.45	4.20	4.75
No. 20	3.65	4.60	4.35	4.90
No. 22	3.70	4.65	4.40	4.95
No. 24	3.85	4.80	4.55	5.10
No. 26	4.10	5.05	4.80	5.35
No. 28	4.35	5.30	5.05	5.60

WELDED STEEL PIPE—Warehouse discounts are as follows

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — Decimal	B.W.G. and Fractions	Outside Diameter in Inches ⅛	¼	⅜	½	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
120" or								
.125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	6.00@7.50	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, ⅛", 8.35c.; ¼, 7.85c.; 5/32 to ½, 7.35c. per lb. *Flat, ⅛@¼-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.50
Tin, 5-ton lots, New York			71.12½
Lead (up to carlots) E. St. Louis	8.45	New York	9.37½
Zinc (up to carlots) E. St. Louis	7.37½	New York	8.25

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	19.00	20.50	17.00
Copper sheets, base	23.00	23.00	23.00
Copper wire, base	20.00	20.00	16.50
Copper bars, base	22.62½	22.62½	22.50
Copper tubing, base	25.00	25.00	25.00
Brass sheets, base	19.37½	19.37½	19.37½
Brass tubing, base	24.25	24.25	23.75
Brass rods, base	17.12½	17.12½	17.12½
Brass wire, base	19.87½	19.62½	19.87½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	27.00	27.00	27.02
Zinc sheets (casks)	13.25	13.05	12.01
Solder (½ and ½), (case lots)	43.50	42.50	38½@42½
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade			88.00
Commercial genuine, intermediate grade			61.00
Anti-friction metal, general service			31.50
No. 4 babbitt (f.o.b.)			14.75
Nickel, f.o.b. refinery, cents per lb.:			
Ingots 35.00 Electrolytic 39.00 Shot			36.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.50 @12.75	11.50	11.25@11.75
Copper, heavy, and wire	11.75 @12.25	11.75	10.75@11.25
Copper, light, and bottoms	10.00 @10.50	10.00	9.50@10.25
Heavy lead	7.25 @ 7.50	7.00	7.00@ 7.50
Tea lead	5.25 @ 5.75	5.00	6.00@ 6.50
Brass, heavy, yellow	7.00 @ 7.50	7.50	7.25@ 7.75
Brass, heavy, red	9.50 @ 9.75	9.75	9.00@ 9.50
Brass, light	6.00 @ 6.25	6.00	6.75@ 7.25
No. 1 yellow rod turnings	8.00 @ 8.25	8.00	7.75@ 8.25
Zinc	4.25 @ 4.75	4.50	4.25@ 4.75

TIN PLATES—American Charcoal—Bright—Per box

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box			
100-lb., 14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box			
IC, 14x20	7.75@8.00	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13@0.17½	$0.18	$0.15@0.20
Cotton waste, colored, per lb.	.10@ .14	.14	.12@.17
Wiping cloths, washed white, per lb	.17½	36.00 per M	.15
Sal soda, per 100 lb. keg	2.05	2.25	2.75*
Roll sulphur, per 100 lb	2.70†	3.50	4.25‡
Linseed oil, per gal., 5 bbl. lots	.87½	1.05	90
Lard cutting oil, 25% lard, per gal.	.55	.50	.48
Machine lubricant, medium-bodied (55 gal. metal bbl.), per gal.	.35	.35	.29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

*Per 175 lb. keg. †In 150-lb. bags. ‡Per 425 lb. barrel.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb	.04	.04	.0415
Brass rods	per lb	.1712½	.1712½	.1687½
Solder (½ and ½)	per lb.	.435	.4062½	.395
Cotton waste	per lb.	.13@.17½	.13@.17½	15@22
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	7.00
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.55	3.55
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	.35
Belting, leather, medium	off list	40–5%	40–5%	40%
Machine bolts, up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.40	$5.84	$5.65
Emery paper	10.71	11.00	10.71
Emery cloth	27.84	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.45	1.49
Cloth	3.10	3.50	3.75
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton	3.50@	3.75
Coke, prompt foundry, Connellsville	per net ton	4.25@	5.00
White lead, dry or in oil	100 lb. kegs	New York,	15.25
Red lead, dry	100 lb. kegs	New York,	15.25
Red lead, in oil	100 lb. kegs	New York,	16.75

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x½-in., 2c. each. Discount 70% for $\frac{5}{16}$-in and smaller and 65% for ⅜-in. and larger.
Case hardened ¼x½-in., 6c. each, less 50%.

Rivets, button heads, ⅜-in., ½-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1¼ to 2-in. long, all diameters, 25c.; ⅜-in. dia., 35c.; ½-in. dia., 75c; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb. 50c.; countersunk heads, 45c.

Washers, cast iron, ⅜-in., $7.00* per 100 lb. at New York warehouses; ½-in., $6.00* per 100 lb

*For immediate delivery from warehouse

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

N. Y. Brooklyn—Premier Specialty Co., 282 Nassau Ave.—No. 1, Townsend riveting machine.

N. Y., Long Island City—Cornell Iron Works, 36-20 13th St.—power punch press for architectural iron work.

O., Columbus—Buckeye Optical Co., 80 East Long St. H. Courtught, Purch. Agt.—complete new equipment for modern optical shop, grinders, etc.

O., Portsmouth—H. S. Howe Co., Scioto Trail—complete equipment for proposed 68 x 137 ft. repair and service garage on Scioto Trail. Estimated cost $37,000.

O., Westerville—W. L. Schott, Westerville—1 drill press, 24 in. lathe, air compressor, for proposed 60 x 170 ft. repair garage. Estimated cost $40,000. J. Q. Adams 247 East Broad St., Columbus, Archt.

W. Va., Huntington—A. C. Love Co., A. C. Love, Purch, Agt.—power bending brake, 10 to 12 ft. long, for 8 gage stock.

Australia, Melbourne—Victorian Government Railways, will receive bids until November 24th, for hole grinding machine including equipment, etc.

Opportunities for Future Business

Ala., Birmingham — Joubert & Goslin, Machinery & Foundry Co., 800 North 35th St., manufacturers of heavy chemical apparatus, drying machines, etc. plans improving and enlarging plant to increase capacity. Estimated cost $250,000. F. L. Joubert, Vice-Pres.

Calif., Fresno—City has had plans prepared for the construction of Edison Technical School, here. Estimated cost $320,000. Feichlin, Shaw & Franklin, Patterson Bldg., Archts.

Calif., Los Angeles—Los Angeles Railway Co., Railway Bldg., awarded contract for the construction of 1 and 2 story, auto shop, on East 15th St. $127,560. Noted July 1.

Calif., Los Angeles—Union Iron Works of Los Angeles, 5125 Santa Fe Ave., will build 153 x 450 ft. fabricating plant, here. Work will be done by company forces. R. P. Miller, Genl. Mgr.

Calif., San Francisco — Anderson-Smith Motor Co., Bush and Van Ness Aves., awarded contract for the construction of 2 story auto sales and service shop building, on Mission St., near Army St. $200,000.

Calif., San Jose—San Tomas Realty Co. has had plans prepared for the construction of 150x170 ft. garage, at Market and Pierce Sts. Binder & Curtis, 35 West San Carlos St., Archts. T. F. Kilmartin, Inc., Lessee.

Calif., Santa Barbara — Santa Barbara High School Dist. will receive bids until October 11, for the construction of manual training shops at high school, here. W. H. Weeks, 369 Pine St., San Francisco, Archt., Former bids rejected. Noted Sept. 2.

Conn., Bridgeport—Grant Manufacturing & Machine Co., Silliman Ave., awarded contract for the construction of 40 x 63 ft. plant, on Silliman Ave.

Conn., New Haven—New Haven Clock Co., 133 Hamilton St. awarded contract for the construction of 2 story, 62x105 ft. factory, on Hamilton St. Estimated cost, $50,000. Noted Sept. 2.

Ill., Chicago—H. G. Fischer Co., 2355 Wabansia Ave., awarded contract for the construction of 2 story, 53 x 109 ft. plant for manufacture of optical instruments, at 2323-25 Wabansia Ave. Estimated cost $75,000.

Ill., Chicago—O. D. Jennings Co., 4329 Lake St., awarded contract for the construction of 2 story, 31x56 ft. plant, for manufacture of coin slot machines, at 4309-29 West Lake St.

Ill., Chicago—Pyle National Co., 1334 North Kostner Ave. awarded contract for the construction of 1 story, 22x61 ft. plant for the manufacture of locomotive and street car headlights, at 1334 North Kostner Ave. Estimated cost $50,000.

Ill., Kankakee—Sears, Roebuck & Co., Arthington and Holman Sts. awarded contract for the construction of 24x60 ft. addition to stove plant, here. Estimated cost $25,000.

Ind., Indianapolis—Marmon Motor Car Co., 1037 North Meridian St., awarded contract for the construction of 40 x 440 ft. addition to Plant 3. Estimated cost $40,000.

Ind., South Bend—W. and C. Loutz Estate, awarded contract for the construction of 2 story, 61x90 ft. machine and repair shops, service station, etc. at Michigan and South Sts. Estimated cost $65,000.

Ind., Terre Haute—A. Fromme Lumber Co., 103 East Paris Ave. has had plans prepared for the construction of 40x100 ft. service, repair and garage building. Estimated cost $40,000. Private plans.

Mass., Boston—Pierce Arrow Co., 696 Commonwealth Ave., will soon receive bids for the construction of 3 story, 100 x 300 ft. sales and service building, at Commonwealth Ave. and Alcorn St. Estimated cost $400,000. H. C. Cook, 408 Pearl St., Buffalo, N. Y., Archt.

Mass., Newton—Fessenden School, Albemarle Rd., awarded contract for the construction of 3 story repair and service garage, on Albemarle Rd. Estimated cost $40,000. Noted Sept. 2.

Mass., Roxbury (Boston P. O.)—Chadwick-Boston Lead Co., 162 Congress St., Boston awarded contract for the construction of 2 story, 65x100 ft. plant at 1 Southampton St. here. Estimated cost $40,000.

Mich., Detroit — Westinghouse Electric & Mfg. Co., 4558 Malbury Grand Ave. awarded contract for the construction of three 3 story buildings, including shops, warehouse, etc. on Trumbull Ave. Esimated cost $400,000.

Mich., Fordson—Ford Motor Co., Highland Park, is receiving bids for the construction of 152x365 ft. administration building and 96x200 ft. garage, here. A. Kahn, 1000 Marquette Bldg., Detroit, Engr.

Minn., St. Paul—American Can Co., 747 Prior Ave. will build 3 story and basement, 100 x 130 ft. addition to manufacturing plant. Estimated cost $125,000. Private plans.

Mo., Kansas City—Agee-Block Realty & Building Co., 405 Commerce Bldg., is having plans prepared for the construction of 4 story, 113 x 150 ft. garage at 1307-17 Main St. Estimated cost $150,000. R. Gornall, 3617 Broadway, Archt.

Mo., Kansas City—Scarritt Estates Co., Scarritt Bldg., plans the construction of 3 story, 92 x 120 ft. garage at 7th and Walnut St. Estimated cost $150,000. Engineer and architect not selected.

N. J., Trenton—Niedt-Ertel Motor Co., Broad and Centre Sts., is having plans prepared for the construction of 1 story, 65 x 200 ft. garage and sales room, here. Estimated cost $50,000. J. O. Hunt, 319 East Hanoven St., Archt.

N. Y., Brooklyn—Brooklyn Edison Co., Pearl St., has had plans prepared for the construction of 6 story, 150 x 500 ft. garage and service building, at 4th Ave. and 3rd St. McKenzie, Voorhies & Gmelin, 342 Madison Ave., Engrs. and Archts.

N. Y., Syracuse—Chemical Toilet Corp., awarded contract for the construction of plant additions, at Glen Ave. and Delaware & Lackawanna R.R. tracks. Estimated cost $100,000.

N. C., Durham—Five Points Auto Co., plans 3 story garage, on Main St. Estimated cost $100,000. Architect and engineer not announced.

O., Cleveland—City, W. R. Hopkins, City Mgr. plans an election November 2 to vote $200,000 bonds for the construction of a 3 story city garage, and $65,000 bonds for addition to machine shop on Croton Ave. H. Kregelius, City Hall, City Engr.

O., Cleveland — Elwell-Parker Electric Co., 42nd St. and St. Clair Ave. M. S. Towson, Pres. and Genl. Mgr., awarded contract for the construction of 4 story, 40 x 120 ft. plant for manufacture of electric trucks and trailers, at 42nd St. and St. Clair Ave. Estimated cost $100,000.

O., Cleveland — Leece-Neville Co., 5363 Hamilton Ave., S. M. Neville, Pres. and Treas. has had plans prepared for the construction of 2 story, 43x100 ft. addition to plant for the manufacture of electric lighting and starting equipment, at 5363 Hamilton Ave. Estimated cost $40,000. W. Watson, and associates 4614 Prospect Ave. Archts.

O., Cleveland—J. Rutkowski, Pres. Cleveland Structural Steel Co., 6,600 Park Ave. awarded contract for the construction of 2 story, 50x259 ft. auto sales and garage building, at 6851 B'way. Estimated cost $150,000. Noted Sept. 23.

O., St. Bernard—St. Bernard Manufacturing Co., c/o Standard Car Wheel Co., 6504 Bessemer Ave., Cleveland, awarded contract for the construction of 105 x 233 ft. foundry, storage buildings, etc., here. Estimated cost $90,000.

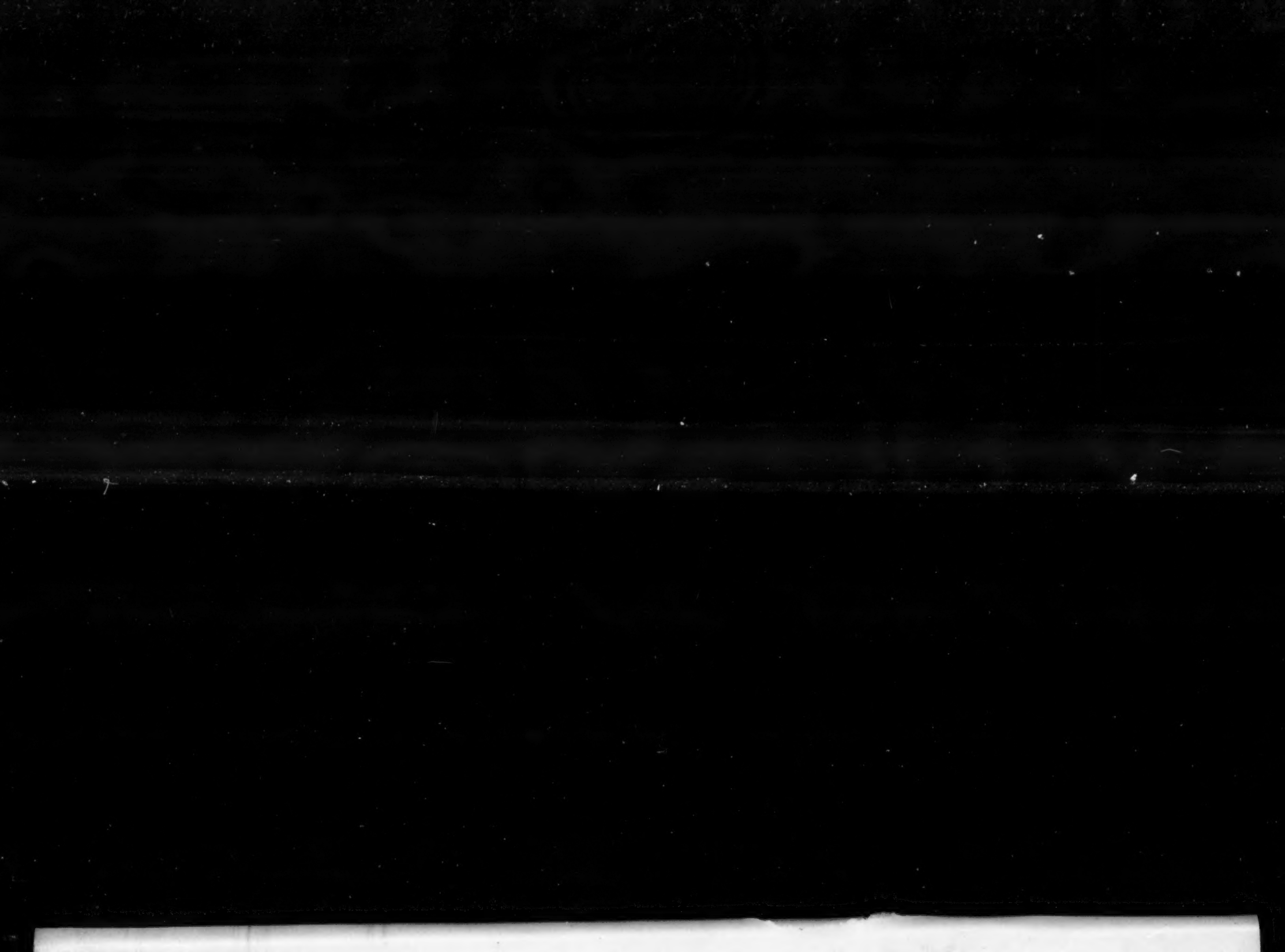
Pa., Meadville—Hookless Fastener Co. awarded contract for the construction of 2 story factory addition, here. Estimated cost $40,000. Noted Aug. 19.

Pa., New Castle—Johnson Bronze Co. awarded contract for the construction of a 3 story, 45 x 153 ft. and 1 story, 50 x 153 ft. additions to plant, here. Estimated cost $100,000.

Pa., Philadelphia—City, Department of Transit awarded contract for the construction of repair shop, inspection building and entrance building at Fern Rock Service Yards, Broad Street Subway. $1,100,000. Noted Sept. 23.

Pa., Williamsport — Williamsport-Buick Co., 405 West 3rd St., awarded contract for the construction of 3 story, ramp type show room and service garage, here. Estimated cost $100,000.

Wis., La Crosse — National Gauge & Equipment Co. awarded contract for the construction of 1 story, 140 x 160 ft. addition to plant, here.

Wis., Madison—Halry & Sayle, Washington Bldg., awarded contract for the construction of 60x150 ft. service station and shop on Main St. Estimated cost $40,000. Private plans.

Wis., Milwaukee—Chain Belt Co., 736 Park St., awarded contract for the construction of 120 x 310 ft. structural shop at 39th St. and Orchard Ave. Noted Sept. 2.